

# Rapid Access Medical X-Ray System X-DEV HF Developer & Replenisher and X-FIX HF Fixer & Replenisher

LIQUID PROCESSING CHEMICALS FOR PRE-HARDENED GENERAL PURPOSE  
X-RAY FILMS IN AUTOMATIC FILM PROCESSORS

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### I. SYSTEM DESCRIPTION

This Fast Processing System consists of single part concentrated **X-DEV HF Developer & Replenisher** and single part concentrated **X-FIX HF Fixer & Replenisher**.

**X-DEV HF Developer & Replenisher** has been formulated to work with pre-hardened general purpose medical X-Ray films from fast (38 sec) to standard (90 sec) processing cycles. **X-DEV HF** is gluteraldehyde free to meet concerns about health effects of gluteraldehyde.

**X-FIX HF Fixer & Replenisher** is a non-hardening fixer for straight replenishment.

### II. GENERAL PROCESS SPECIFICATIONS

#### Time and temperature

**X-DEV HF Developer & Replenisher** and **X-FIX HF Fixer & Replenisher** may be utilised over a wide processing time range to suit individual processing conditions available in the market. Typical dry-to-dry times are 38, 45, 53, 60 and 90 seconds. Though development time is variable, it is recommended to run at 35°C for a starting condition in all cases.

#### A. Replenishment rates

As a starting point it is recommended to replenish both developer and fixer with 600 ml/m<sup>2</sup> of film processed.

Differences in application may lead to variability in overall exposure of the films. Replenishment rates should be optimised to fit individual circumstances of exposure, film types and total throughput. If the processor is subject to low film usage or long periods of inactivity, aerial oxidation will occur and it will be necessary to increase developer replenishment rates to maintain adequate activity.

### III. MIXING INSTRUCTIONS

#### X-DEV HF Developer & Replenisher

Developer bath and replenisher are made to the same strength, no starter is needed for the developer.

**Table 1 Mixing instructions Developer & Replenisher**

<b>X-Dev HF Developer &amp; Replenisher</b>		
To make 15 litre	Water	Conc
Tank from conc.	9 L	6 L
Replenisher from conc.	9 L	6 L

**A. X-FIX HF Fixer & Replenisher**

Fixer bath and replenisher are made to the same strength, no hardener is required for pre-hardened emulsions.

**Table 2 Mixing instructions Fixer**

<b>X-Fix HF Fixer &amp; Replenisher</b>		
To make 20 litre	Water	Conc
Tank from conc.	15.5 L	4.5 L
Replenisher from conc.	15.5 L	4.5 L

**IV. PH AND DENSITY SPECIFICATION**

Table 3 lists the pH and density specification for fresh working solutions. Seasoned working solutions will slightly increase in density due to evaporation. pH may increase or decrease slightly for both developer and fixer baths while seasoning, depending on the specific customer conditions.

**Table 3 pH & Density specification**

<b>Solution</b>	<b>pH (25°C)</b>	<b>Density (20°C) g/cm<sup>3</sup></b>
<b>X-DEV HF Developer &amp; Replenisher</b>	10.40 ± 0.05	1.100 ± 0.003
<b>X-FIX HF Fixer &amp; Replenisher</b>	4.80 ± 0.05	1.085 ± 0.003

**V. CONTINUOUS ELECTROLYTIC FIXER DESILVERING**

In order to substantially reduce the fixer replenishment rate and to reduce silver carry-over into the processor wash tank FUJIFILM recommends the use of a suitable fixer desilvering unit.

The silver content of the processor fixing bath should be maintained at 0.3 - 1.0 of silver/L.

**VI. PROCESSOR TANK CLEANLINESS**

If the processor shows signs of dirt or crystals built up on rollers, tank or cross-overs, the machine should be emptied, thoroughly washed out and then filled with FUJIFILM **Unicleaner PD** solution. Read instructions packed with the cleaner before use to avoid damage to machine or chemical reactions. Remember to carefully clean off any deposit on the cross-over mechanism, otherwise scratching of the emulsion may occur.

## **VII. FILM WASHING**

Ensure adequate washing of films is achieved by adhering to processor manufacturer's recommendations. If an electrolytic fixer desilvering unit is used in a continuous mode with the processor's fixer tank solution the carry-over of silver into the wash tank will be substantially reduced. This has the benefit of reducing the amount of silver complex in the processor wash water effluent. Normally a reduction to about 1/10<sup>th</sup> of the normal concentration can be achieved.

## **VIII. BIOLOGICAL GROWTH IN WASH TANK**

### **Open wash system**

It is not usual for biological growth to be found in well-maintained processors with open wash systems and adequate wash water flow rates (1 - 3 litres/minute). If problems are experienced it is best to first have an examination of the water quality and supply system, carried out by a specialist company.

Various biocides compatible with photographic processors are available. FUJIFILM **Algstop LR** is very effective in preventing algae growth during shutdown periods. It is only necessary to add 1 ml of **Algstop LR** concentrate for each litre of wash water capacity to the wash tank at the end of a processing session.

An automatic **Algstop Dosing Unit** is available from FUJIFILM.

### **Closed, recirculated wash systems**

In the low wash water usage and high temperature conditions resulting from recirculation of wash water, it has proven to be difficult to keep bio-growth under control.

**Algstop LR** from FUJIFILM is the recommended product for these difficult conditions.

For full details on the usage of **Algstop LR**, please ask for the separate FUJIFILM Technical Info Sheets "**AlgStop**".

**Use biocides safely. Always read the label and product information before use !**

## IX. TROUBLESHOOTING GUIDE

Problem	Possible Cause	Action to be taken
Light Image.	<ol style="list-style-type: none"> <li>1. Developer temperature too low.</li> <li>2. Under replenishment of developer.</li> <li>3. Exhausted developer.</li> <li>4. Developer contaminated by fixer.</li> <li>5. Over diluted developer.</li> <li>6. Mixing error.</li> <li>7. Weak or insufficient exposure.</li> <li>8. Processing time too short.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the temperature with a thermometer and adjust setting.</li> <li>2. Check replenishment pumps &amp; settings and adjust accordingly.</li> <li>3. Make new fresh solution.</li> <li>4. Check mixing procedures – if needed make new fresh solution.</li> <li>5. Check mixing procedures – if needed make new fresh solution.</li> <li>6. Check mixing procedures – if needed make new fresh solution.</li> <li>7. Check equipment used for exposure.</li> <li>8. Check speed of processor and adjust it if required.</li> </ol>
Light Image (sudden effect).	Developer contamination* by fixer.	Check mixing procedures – make new developer solution.
Image too dense.	<ol style="list-style-type: none"> <li>1. Developer temperature too high.</li> <li>2. Over replenishment of developer.</li> <li>3. Processing time too long.</li> <li>4. Overexposed film.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the temperature with a thermometer and adjust settings.</li> <li>2. Check replenishment rates, pumps &amp; settings and adjust accordingly.</li> <li>3. Check speed of processor and adjust accordingly.</li> <li>4. Check equipment used for exposure.</li> </ol>
Fogged film.	<ol style="list-style-type: none"> <li>1. Unsuitable darkroom light.</li> <li>2. Light leak into darkroom.</li> <li>3. Unsuitable darkroom light.</li> <li>4. Light leak into darkroom.</li> </ol>	<ol style="list-style-type: none"> <li>1. Follow film manufacturer's recommendations. Safety light must be at distance of 1,2 m min. Check if light bulb is of the correct type.</li> <li>2. Examine darkroom for light leaks.</li> <li>3. Follow film manufacturer's recommendations. Safety light must be at distance of 1.2 m min. Check if light bulb is of the correct type.</li> <li>4. Examine darkroom for light leaks.</li> </ol>
Mottles.	Developer rollers are excessively worn or damaged.	Change rollers if thorough cleaning proves to be insufficient.
Film does not dry.	<ol style="list-style-type: none"> <li>1. Drying temperature too low.</li> <li>2. Wash-water flow too low.</li> <li>3. Ineffective fixer.</li> <li>4. Relative humidity too high.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check temperature and raise if necessary.</li> <li>2. Check flow rate &amp; temperature and adjust to standard.</li> <li>3. Check replenishment rate and adjust accordingly.</li> <li>4. Dry the air in working area.</li> </ol>
White spots on light areas of film.	<ol style="list-style-type: none"> <li>1. Fixer temperature too low.</li> <li>2. Under replenished fixer.</li> <li>3. Mixing error for fixer.</li> <li>4. Insufficient wash.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check with reliable thermometer and adjust accordingly.</li> <li>2. Check rate of replenishment and adjust as necessary.</li> <li>3. Check mixing procedure and mixing tank calibration.</li> <li>4. Check wash flow rate and increase as required.</li> </ol>
Small particles on film.	Dirt in solution.	Check solution circulation, filter and pump.

<b>Problem</b>	<b>Possible Cause</b>	<b>Action to be taken</b>
White transparent spots on films.	<ol style="list-style-type: none"> <li>1. Spilling or splashing of fixer before processing.</li> <li>2. Soiled screen.</li> <li>3. Particles of emulsion lifting from film.</li> <li>4. Air bubbles between roller and film in developer.</li> </ol>	<ol style="list-style-type: none"> <li>1. Handle films with care and clean hands.</li> <li>2. Clean screen.</li> <li>3. Clean rollers. Check that fixer replenishment rate is sufficient.**</li> <li>4. Check solution circulation, pump and filter.</li> </ol>
White or dark halfmoon shaped marks on film.	Film has been folded or bent before processing.	Handle film with care, do not bend.
Parallel black & transparent stripes.	Uneven pressure from distorted rollers in the developer section of the processor.	Clean machine thoroughly - have machine manufacturer check rollers.
Parallel black & transparent stripes.	Uneven pressure from distorted rollers in the developer section of the processor.	Clean machine thoroughly - have machine manufacturer check rollers.
Dark black marks.	<ol style="list-style-type: none"> <li>1. Electrostatic discharge.</li> <li>2. Pressure applied during handling.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check relative humidity.</li> <li>2. Handle films smoothly and with care.</li> </ol>
Dark or light spots on film (comet shaped).	Splashing of chemicals (fixer or detergents) before processing.	Clean up working & loading areas.
Soiled film after drying.	Drying temperature too high.	Check temperature and adjust it to recommended value.
White layer on film.	<ol style="list-style-type: none"> <li>1. Wash flow rate too low.</li> <li>2. Soiled/exhausted fixer bath.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check flow rate &amp; temperature of wash water - adjust if needed.</li> <li>2. Check mixing procedure - prepare new fix solution. Check fix replenishment rate.</li> </ol>
Yellow stain on film after storage.	Insufficient fixation.	Ensure fixer** replenishment rate is correct.
Scratches on film.	<ol style="list-style-type: none"> <li>1. Along the entire length of the film.</li> <li>2. Along the direction of feed of film into processor (often with round areas of higher density).</li> </ol>	<ol style="list-style-type: none"> <li>1. Guide rails scratching film. Process another film with its long axis at right angles to the direction in which the previous film was processed. This will show whether the scratches occur before loading into processor or during processing.</li> <li>2. Excessive pressure applied to film by fingers when inserted into feed slot of processor.</li> </ol>

\* : When filling a processor with developer and fixer solution always mix and install fixer before developer to avoid fixer splashing into developer. Always rinse developer tank and rollers thoroughly with water after installing fixer before installing developer. Use separate mixing tanks.

\*\* : The condition of a fixer can be judged by its silver content. Normally the silver concentration should not exceed 4 g/litre. If it is too high this indicates too low a rate of replenishment. Silver concentration can be measured by silver test strips available from various laboratory chemical suppliers or from Merck.

## **X. STORAGE**

Liquid developer and fixer concentrates should be stored above 5°C to prevent crystallisation. Storage temperature above 25°C will cause premature ageing.

## **XI. HANDLING PROCESSING SOLUTIONS**

Always read the hazard information on the packs of solution concentrate before attempting to handle the solutions. Read the MSDS (Material Safety Data Sheets). These are available on request if you do not have a copy.

All photographic processing solutions can exert harmful effects when brought into contact with human tissue to a greater or lesser extent depending on the nature of the solution and its concentration. All users of such solutions should exercise the greatest care to avoid the chemicals contacting the skin, eyes or other parts of the body. Always wear solution resistant gloves and effective eye protection.

In case of accidental contact with processing solutions wash the affected part with plenty of clean cold running water. Wash with an acidic soap and rinse thoroughly with water. Consult a medical doctor. Some photographic solutions produce irritating vapours therefore thorough ventilation is essential. Do not inhale air above processing solutions.