14 DIAGNOSTIC CHARTS

The diagrams in this section provide you with a step-by-step approach to diagnosing processing problems. Summary charts show which detailed chart to consult for your problem. The charts give probable causes and suggest corrective procedures. Remedies for some processing problems are described in section 3, “Process Monitoring,” and section 5, “Corrective Actions for Processing Solutions.”

<table>
<thead>
<tr>
<th>Chart</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Preliminary</td>
</tr>
<tr>
<td>B</td>
<td>Summary—Control-Chart Plots</td>
</tr>
<tr>
<td>C</td>
<td>Control-Chart Plots—High D-max</td>
</tr>
<tr>
<td>D</td>
<td>Control-Chart Plots—Low D-max</td>
</tr>
<tr>
<td>E</td>
<td>Control-Chart Plots—Red or Green Color Balance</td>
</tr>
<tr>
<td>F</td>
<td>Control-Chart Plots—Blue Color Balance</td>
</tr>
<tr>
<td>G</td>
<td>Control-Chart Plots—Cyan, Magenta, or Yellow Color Balance</td>
</tr>
<tr>
<td>H</td>
<td>Control-Chart Plots—Green, Yellow, Yellow/Red, or Yellow/Green Color Balance</td>
</tr>
<tr>
<td>I</td>
<td>Control-Chart Plots—Low Activity—One or More Density Values Plot High</td>
</tr>
<tr>
<td>J</td>
<td>Control-Chart Plots—Low Activity—One or More Density Values Plot High</td>
</tr>
<tr>
<td>K</td>
<td>Control-Chart Plots—High Activity—One or More Density Values Plot Low</td>
</tr>
<tr>
<td>L</td>
<td>Control-Chart Plots—High D-min</td>
</tr>
<tr>
<td>M</td>
<td>Summary—Visual Appearance</td>
</tr>
<tr>
<td>N</td>
<td>Visual Appearance—First Developer and Reversal Bath</td>
</tr>
<tr>
<td>O</td>
<td>Visual Appearance—Color Developer</td>
</tr>
<tr>
<td>P</td>
<td>Visual Appearance—Pre-Bleach, Bleach, Fixer, and Final Rinse</td>
</tr>
<tr>
<td>Q</td>
<td>Visual Appearance—Film—Surface Dirt</td>
</tr>
<tr>
<td>R</td>
<td>Visual Appearance—Film—Muddy or Grainy</td>
</tr>
<tr>
<td>S</td>
<td>Visual Appearance—Film—Scum</td>
</tr>
<tr>
<td>T</td>
<td>Visual Appearance—Film—Scratches</td>
</tr>
<tr>
<td>U</td>
<td>Visual Appearance—Film—Emulsion Marks</td>
</tr>
<tr>
<td>V</td>
<td>Visual Appearance—Film—Density Marks</td>
</tr>
<tr>
<td>W</td>
<td>Visual Appearance—Film—Dark Images</td>
</tr>
<tr>
<td>X</td>
<td>Visual Appearance—Film—Light Images</td>
</tr>
<tr>
<td>Y</td>
<td>Visual Appearance—Film—High or Low Contrast</td>
</tr>
</tbody>
</table>
Chart A

PLOT PROBLEM

Tolerance limit(s) exceeded on control chart

CHECK THE OBVIOUS

CHECK CONTROL STRIP

CHECK FOR OPERATOR ERROR

• Plots on Y-55 Form done correctly?
• Error in reading control strip?
  (Reread control strip)
  - Area to be read correctly centered and
  free of defects?
  - Emulsion side placed correctly?
  - Densitometer read correctly?
  - Correct densitometer filters used?
  - Correct step on control strip for parameter plotted?
• Correct control-strip code number plotted?

CHECK FOR PHYSICAL DEFECTS

• Correct handling and storage?
• Control strip damaged when processed?
• Manufacturing deficiency?

CHECK DENSITOMETER

• Correct usage by operator?
  - Instrument warmed up?
  - Correct filters used?
  - Zeroed and sloped correctly?
• Malfunction of instrument?

Problem Found

Correct

Process

Problem Not Found

Go to Chart B

CHECK REFERENCE STRIP

CHECK FOR OPERATOR ERROR

• Reference strip of same code as control strip?
• Correct readings?
• Correction factors used correctly for crossover procedure?
• Reference values correctly transferred to Y-55 Form?

CHECK FOR PHYSICAL DEFECTS

• Correct handling and storage?
• Manufacturing deficiency?
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**Chart B**
Summary-Control-Chart Plots

**MATCH PROBLEM PARAMETER**

**DESCRIBE PLOT PROBLEM**

**FURTHER IDENTIFY AND GO TO CHART SPECIFIED**

- **D-max**
  - High D-max
    - See Chart C
  - Low D-max
    - Red plot - low
      - Green plot - low
        - Blue plot - low
      - Low D - max
        - (One or more plots below tolerance and all 3 plots below zero line in HD or LD parameters)
    - Red and green plots - both low
      - See Chart E
  - See Chart D

- **Color (HD)**
  - Improper Color Balance (Plots spread apart with spread between lowest and highest exceeding either color-balance tolerance)
  - Red color balance (Red plot apart from and lower than other two)
    - Green color balance (Green plot apart from and lower than other two)
      - Blue color balance (Blue plot apart from and lower than other two)
    - Cyan color balance (Cyan plot apart from and lower than other two)
      - Magenta color balance (Magenta plot apart from and lower than other two)
    - Yellow or yellow/red color balance (Blue plot apart from and higher than green and red plot apart from and lower than green)
      - Yellowgreen color balance in HD parameter (Cyan blue in LD parameter. (Blue plot apart from and higher than red HD and green plot apart from and lower than red HD. Red apart form and higher than green LD and blue apart form and lower than green LD)

- **Speed (LD)**

- **Toe Density (TD)**

- **D-min**
  - High D-min
    - See Chart L
  - Low D-min
    - (Not significant)
Chart C
Control-Chart Plots
High D-max

**CHOOSE PROBABLE CAUSE**

- First developer too dilute
- Color developer too dilute
- First and color developers under-replenished
- First and color developer reversed
- First developer omitted

**VERIFY CAUSE**

- Check specific gravity
- Check replenishment rate and calibration of replenisher measuring devices. Recalculate film load of average rack.
- Check mix and operating procedures
- Check operating procedure

**ELIMINATE CAUSE**

- Check mix and solution tanks
- Check mixing techniques
- On in-line replenishment systems, check settings on concentrate and water pumps and adjust to specifications
- Adjust to specifications
- Correct mix and operating procedure
- Thoroughly clean both tanks

**ELIMINATE SYMPTOM**

- Depending on the severity of the situation:
  a. Wait and tolerate
  b. Risk a prescription
  c. Dump partially
  d. Dump solution

**PREVENT RECURRENCE**

- Take steps to prevent the problem in the future
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Chart D
Control-Chart Plots
Low D-max

**CHOOSE PROBABLE CAUSE**
- High first wash temperature
- Underaerated bleach
- Overconcentrated pre-bleach
- Loss of reversal bath activity

**VERIFY CAUSE**
- Check temperature with an accurate thermometer
- Check bleach
- Check specific gravity, mix procedure, calibration mix tank, and replenisher pumps
- Check agitation of first and/or color developer

**ELIMINATE CAUSE**
- Adjust wash temperature to 92-103°F (33-39°C)
- Properly aerate bleach
- Correct problem
- Adjust to specifications

**ELIMINATE SYMPTOM**
- Calibrate mix tank
- Correct mix procedure
- Adjust pumps

**PREVENT RECURRENT**
- Depending on the severity of the situation:
  a. Wait and tolerate
  b. Risk a prescription
  c. Dump partially
  d. Dump solution
- Take steps to prevent problem in the future

- Low red D-max
  - Plot below tolerance limits (-0.20 or -0.25)
  - Low green D-max
    - Plot below tolerance limits (-0.20 or -0.25)
    - Low blue D-max
      - Plot below tolerance limits (-0.20 or -0.25)

- Low green D-max
  - Plot below tolerance limits (-0.20 or -0.25)
  - Overconcentration of first developer
    - First developer contaminated with fixer

- Low blue D-max
  - Plot below tolerance limits (-0.20 or -0.25)
  - Overreplenishment of first developer
    - First developer contaminated with fixer

- Low D-max
  - Plot below tolerance (-0.20 or -0.26)
  - One or more plots below tolerance and all 3 plots below zero line in HD or LD

- Too little first developer starter
- Correct mix procedure
- Correct splash shields
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14-7
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Chart H
Control-Chart Plots
Yellow Color Balance

CHOOSE PROBABLE CAUSE

VERIFY CAUSE

ELIMINATE CAUSE

ELIMINATE SYMPTOM

PREVENT RECURRENT

Yellow Color Balance
- Blue plot spread apart from and higher than red and green
- Transparencies appear too yellow

- Reversal bath slightly oxidized
- Check for floating cover, air agitation or excess nitrogen agitation, long turnover time, air in flexible container, and storage temperature
- Install floating covers
- Use nitrogen agitation
- Correct flexible-container storage conditions
- Do not store chemicals beyond suggested storage life

- Low color-developer temperature
- Check temperature with accurate thermometer
- Adjust color-developer temperature

- Too much first developer starter
- Check mix procedure and calibration of solution tank
- Calibrate mix tank; check mixing technique
- Adjust to specifications

- Roll film exposed through the base (very yellow overall)
- Color developer starter added to first developer
- Check mix procedure and calibration of solution tank
- Calibrate mix tank; check mixing technique
- Adjust to specifications

- Too much first developer starter
- First and color developers underreplenished
- Recalculate film load of average rack
- Adjust to specifications

Yellow/red Color Balance
- Blue plot spread apart from and higher than red and green
- Transparencies appear too yellow-red

- Color developer starter added to first developer
- Check mix procedure and calibration of solution tank
- Calibrate mix tank; check mixing technique
- Adjust to specifications

Yellow/green HD Cyan/blue LD
- Blue plot spread apart from and higher than red HD and green plot spread apart from and lower than red HD
- Red plot spread apart from and higher than green LD and blue plot spread apart from and lower than green LD
- Transparencies appear too yellow/green in shadows and cyan/blue in lighter areas

- Color developer contaminiated with fixer
- Review contamination control procedures
- Thoroughly rinse mixing tank before mixing color developer. Avoid mixing developers in tanks used to mix other solutions
Chart I
Control-Chart Plots
Low Activity—One or More Density Values Plot High

**CHOOSE PROBABLE CAUSE**

- Low temperature
- Short time
- Low concentration
- Low agitation
- Underreplenishment
- Oxidation
- Too much first developer starter
- Color developer starter used (substantial speed loss especially in the blue)
- Color developer under-replenished
- Low utilization

**VERIFY CAUSE**

- Check temperature with accurate thermometer
- Check time with stop watch
- Check rack threading on continuous processor
- Check specific gravity
- Check replenisher pumps
- Check nitrogen supply and distributors
- Check replenishment rate and calibration of replenisher measuring devices. Recalculate film load of average rack
- Check for floating covers, air agitation, long turnover time, air in flexible container, and storage temperature
- Check mix procedure and calibration of solution tank
- Check replenishment rate
- Check calibration of replenisher measuring device
- First-developer tank turnover every 3 weeks required

**ELIMINATE CAUSE**

- Adjust temperature
- Adjust to specifications
- Adjust to specifications
- Adjust to specifications
- Install floating covers
- Use nitrogen agitation
- Correct flexible-container storage conditions
- Do not store chemicals beyond suggested storage life
- Correct mix procedures
- Adjust to specifications

**ELIMINATE SYMPTOM**

- Depending on the severity of the situation:
  - a. Wait and tolerate
  - b. Risk a prescription
  - c. Dump partially
  - d. Dump solution

**PREVENT RECURRENCE**

- Take steps to prevent the problem in the future

---

Slow Process First Developer (low activity)
- One or more plots above tolerance limits
- All three plots above zero line
- Transparencies appear too dark

- Check replenishment rate and calibration of replenisher measuring device. Recalculate film load of average rack
- Check mix procedure and calibration of solution tank
- Check mixing technique systems, check settings of concentrate and water pumps
- Install floating covers
- Use nitrogen agitation
- Correct flexible-container storage conditions
- Do not store chemicals beyond suggested storage life
- Correct mix procedures
- Adjust to specifications

- Depending on the severity of the situation:
  - a. Wait and tolerate
  - b. Risk a prescription
  - c. Dump partially
  - d. Dump solution

- Take steps to prevent the problem in the future
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**Chart J**

Control-Chart Plots
Low Activity—One or More Density Values Plot High

**CHOOSE PROBABLE CAUSE**
- Moderately low concentration
- Underreplenishment
- Oxidation
- Color developer has too much Part B

**VERIFY CAUSE**
- Check specific gravity
- Check replenisher pumps
- Check replenishment rate and calibration of replenisher measuring device
- Check for floating cover, air agitation, long turnover time, air in flexible container, and storage temperature
- Check mix procedure
- For in-line replenishment systems, check for too-high setting on Part B pump or too-low setting on Part A pump. Also see if Part A replenisher is empty or Part A line is blocked

**ELIMINATE CAUSE**
- Calibrate mix tanks
- Correct mix procedures
- For in-line replenishment systems, check settings on concentrate and water pumps
- Check for cracks in tank
- Install floating cover
- Use nitrogen agitation
- Correct flexible-container storage conditions
- Do not store chemicals beyond suggested storage life
- Correct mix procedure
- Adjust in-line replenishment system

**ELIMINATE SYMPTOM**
- Recalculate film load per average rack; adjust replenisher to specs
- Depending on the severity of the situation:
  a. Wait and tolerate
  b. Risk a prescription
  c. Dump partially
  d. Dump solution

**PREVENT RECURRENT**
- Take steps to prevent the problem in the future

**Symptoms**
- Slow Process
- Color Developer (low activity)
  - One or more plots above tolerance limits
  - Air in flexible container
  - Transparencies too dark

**Methodology**
- Choose probable cause
- Verify cause
- Eliminate cause
- Eliminate symptom
- Prevent recurrence
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Chart L
Control-Chart Plots
High D-min

CHOOSE PROBABLE CAUSE

Loss of fixer activity
NOTE: Transparencies may have overall high density and blue shadows when viewed through the base

Loss of bleach activity

Loss of pre-bleach activity

Inadequate first-developer agitation

CHECK STORAGE, REPLENISHMENT, RATE, TIME, TEMPERATURE, AGITATION, AND PUMPS

VERIFY CAUSE

Check time, temperature, agitation, replenishment, storage, mix procedure, and pumps

Check aeration, time, temperature, agitation, replenishment rate, specific gravity, and inadequate squeegeeing after color developer and after pre-bleach

Check storage, replenishment, rate, time, temperature, agitation, mix procedure, specific gravity, and pumps

ELIMINATE CAUSE

Adjust to specifications

ELIMINATE SYMPTOM

Depending on the severity of the situation:
- a. Wait and tolerate
- b. Risk a prescription
- c. Dump partially
- d. Dump solution

PREVENT RECURRENT

Take steps to prevent the problem in the future

NOTE: If accompanied by slow process, solve that problem before proceeding with this chart

High D-min
NOTE: Transparencies may have overall high density and blue shadows when viewed through the base

NOTE: Transparencies may have overall high density and blue shadows when viewed through the base

NOTE: Transparencies may have overall high density and blue shadows when viewed through the base
Chart M
Summary—Visual Appearance

PROCESsing SOLUTION

- First developer
- Reversal bath

- Color developer

- Pre-bleach
- Bleach
- Fixer
- Final rinse

GO TO CHART

Chart N
Chart O
Chart P

PRODUCT PROBLEM

- Surface dirt

- Muddy appearance
- Grain or mottle

- Scum

- Scratches and abrasion

- Emulsion marks

- Density marks
- Pressure marks
- Light fog
- Static marks

- Dark film

- Light images

- Contrast problems

GO TO CHART

Chart Q
Chart R
Chart S
Chart T
Chart U
Chart V
Chart W
Chart X
Chart Y
Chart N
Visual Appearance
First Developer and Reversal Bath

**VISUAL PROBLEM**
- Foam
- Precipitates
- Abnormal Solution Color
- Solution Color
- Biological Growth

**CHOOSE PROBABLE CAUSE**
- Excessive agitation
- Air from pump (evidenced by extremely small bubbles)
- Silver accumulation on rollers or gears
- Salt from oxidation of first developing agent (gray or white)
- Oxidation (brownish color)
- Dyes leaching out of film
- Contaminated water
- Reversal bath particularly susceptible to biological growth

**VERIFY CAUSE**
- Check burst time on and off
- Check bubble size
- Use soft or distilled water to mix the first developer
- Use uncontaminated water
- Use nitrogen only

**ELIMINATE CAUSE**
- Adjust agitation to specifications
- Tighten connection on vacuum side of pump
- Filter the first developer
- Use soft or distilled water to mix the first developer
- Use uncontaminated water
- Use nitrogen only

**ELIMINATE SYMPTOM**
- **First Developer**
  - Always store first developer tank and replenisher solutions with a floating lid
  - Do not overheat or overaerate first developer
  - Do not aerate first developer.
  - Use nitrogen only

- **Reversal Bath**
  - Dump reversal bath
  - Clean tank as follows: Flush system with hot water Fill tanks, lines, and replenishment system with 30 to 50 mL/L of household bleach solution.
  - Let stand for no more than 1 hour. Flush with water and refill.

**PREVENT RECURRENCE**
- Check bubble size on and off
- Check burst time on and off
- Replace reversal bath regularly
- Replace solution

**Symptoms**
- Biological Growth
- Contaminated water
- Solution Color
- Foam
- Precipitates
- Abnormal Solution Color

**Probable Causes**
- Excessive agitation
- Air from pump (evidenced by extremely small bubbles)
- Silver accumulation on rollers or gears
- Salt from oxidation of first developing agent (gray or white)
- Oxidation (brownish color)
- Dyes leaching out of film
- Contaminated water
- Reversal bath particularly susceptible to biological growth

**Prevent Recurrence**
- Always store first developer tank and replenisher solutions with a floating lid
- Do not overheat or overaerate first developer
- Do not aerate first developer.
- Use nitrogen only

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Chart D
Visual Appearance
Color Developer

PREVENT RECURRENT

ELIMINATE SYMPTOM

Check bubble size
on and off
Check burst rate

Check N generator

ELIMINATE CAUSE

Do not use oxidized Part B solution.

Adjust agitation to specifications

Tighten connections on vacuum side of pump

Verify cause

Oxidation of solution. Look for air leaks in lines and replenishment container

Excessive agitation on and off

Check bubble size

Air from pump

Check N:2 generator

Choose probable cause

Abnormal color (particularly blue-black color in Part B solution)

Foam

Crystals (particularly prevalent in roller-transport gears where color developer solution has evaporated)

Eliminate cause

ELIMINATE CAUSE

Dump tank solution. Clean tank and replace solution.

Rinse crystals off tank and regularly check problem areas.

Verify cause

PREVENT RECURRENT

Check problem area to quality

Color Developer

Visual Appearance Chart O

Color Developer
Chart R
Visual Appearance
Film—Muddy or Grainy

**VISUAL PROBLEM**

- **Muddy Appearance**
  - Retained silver (muddy appearance)
  - Retained silver halide (muddy appearance)

- **Grain or Mottle**
  - Sulfurized fixer (white grain or mottle)

**CHOOSE PROBABLE CAUSE**

- **Muddy Appearance**
  - Retained silver (muddy appearance)
  - Retained silver halide (muddy appearance)

- **Grain or Mottle**
  - Sulfurized fixer (white grain or mottle)

**VERIFY CAUSE**

- Check mix procedures
- Check for proper time, temperature, agitation in fixer
- Check for adequate bleach regeneration by air agitation
- Check replenishment rate
- Adjust replenishment rate
- Check replenisher pumps
- Adjust replenisher pumps
- Adjust air agitation
- Adjust to specifications
- Check replenishment rate

**ELIMINATE CAUSE**

- Adjust air agitation
- Adjust to specifications
- Adjust replenishment rate
- Dump fixer replenisher (not through CRC)
- Dump fixer replenisher (through CRC)
- Dump fixer through CRC. Start with fresh chemicals.
- Dump fixer through CRC. Start with fresh chemicals.

**ELIMINATE SYMPTOM**

- Aerate bleach
- Check problem areas regularly

**PREVENT RECURRENCE**

- Start with fresh chemicals.
- Dump fixer through CRC.
- Prepare replenishers according to package directions.
- Check mix procedures
- Adjust to specifications
- Dump fixer through CRC.
- Generally, air agitation is not recommended for bleach or fixer solutions in roller-transport processors or helical path continuous processors with top rollers above solution level.
PROBLEM VISUAL PROBLEM
CHECK PROBABLE CAUSE
VERIFY CAUSE
ELIMINATE CAUSE
ELIMINATE SYMPTOM
PREVENT RECURRENT

Scum

Final rinse exhausted
Check final rinse
Replace solution regularly

Excess defoamer used, or defoamer added directly to any solution
Check all solutions where defoamer has been added
Follow package instructions for use of defoamer
Replace solution

Final rinse too concentrated
Check mix procedures
Correct mix procedure. Using distilled water to mix final rinse is sometimes helpful
Replace final rinse
Check problem areas regularly

Pre-bleach requires regular replacement
Check pre-bleach
Replace pre-bleach regularly
Replace pre-bleach
Chart T
Visual Appearance
Film—Scratches

**CHOOSE PROBABLE CAUSE**

- Obstruction in machine such as clips, film, or rack parts
- Film tangling
- Loading/handling problem
- Dirt or chemical buildup
- Continuous processor
- Mechanical problems
- Splicing problems

**VERIFY CAUSE**

- Check all tanks and dryer
- Check agitation
- Check racklift
- Check loading technique
- Check rollers, squeegees, and racks
- Check for worn or damaged rollers, squeegees, or racks
- Check splicer

**ELIMINATE CAUSE**

- Remove obstruction. Use care in handling.
- Adjust to proper agitation
- Adjust lift according to manufacturer’s specifications
- Use correct loading technique
- Clean affected area or replace squeegees
- Establish regular maintenance procedures
- Replace parts
- Establish regular maintenance habit
- Fix splicer if necessary

**PREVENT RECURRENCE**

- Check problem areas regularly
Chart V
Visual Appearance
Film—Density Marks

VISUAL PROBLEM

Pressure Marks
- Check handling technique (kinks)
- Processor tension

Light Fog
- Safe light
- Faded filter on infrared illuminator
- Light leak in splicer, machine, wall, door jamb, etc

Static Marks
- Splicer
- Machine
- Film-handling technique

CHOOSE PROBABLE CAUSE

CHECK HANDLING TECHNIQUE

VERIFY CAUSE

Check handling technique

Handle with care

ELIMINATE CAUSE

Check mechanical adjustment

Adjust mechanical problem

ELIMINATE SYMPTOM

Check darkroom area for light leaks

Eliminate light leak

PREVENT RECURRENT

If possible, perform all operations in areas with relative humidity between 45 and 65 percent and temperature between 65 and 75°F (18 to 24°C). Keep film in original sealed packages and store at recommended temperature until ready to use. Do not handle materials any more than is necessary. Avoid sudden, quick movements of film which could cause friction. Avoid winding or unwinding film too rapidly or too tightly. Keep all equipment in clean condition and good working order. Keep film-loading room and processing room as free from dust as possible.
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**VISUAL PROBLEM**

- Dark overall
- Dark Film
- Dark overall or random
- Dark overall and red (sheet film)

**CHOOSE PROBABLE CAUSE**

- Inadequate time or low temperature in first developer
- First developer diluted, exhausted, or underreplenished
- Exposure error by picture-taker
- Color developer starter added to first developer
- Bleach or fixer (or both) omitted, reversed, diluted, exhausted, or underreplenished
- Pre-bleach oxidized
- Exposure error (sheet film exposed through base)

**VERIFY CAUSE**

- Check first developer time and temperature
- Check specific gravity and replenishment rate
- Notify customer of possible camera problem
- Check mix procedure
- Check specific gravity
- Check processing procedure
- Check mix procedure
- Check replenishment rate
- Check replenishment pumps

**ELIMINATE CAUSE**

- Adjust to specifications:
  - Adjust replenishment rates
  - Correct mixing procedure
  - Adjust replenisher pumps
- Correct mix procedure
- Correct processing error
- Correct mix procedure
- Adjust replenishment rate
- Adjust pumps

**ELIMINATE SYMPTOM**

- Depending on severity, clean tank and replace solution
- Depending on severity, dump bleach and/or fixer, clean tank, and replace solution

**PREVENT RECURRENT**

- Check problem areas regularly
- Load camera properly
- Check processing error
- Notify customer of possible camera problem
- Adjust to specifications
- Correct mix procedure
- Adjust pumps
- Correct processing error
- Correct mix procedure
- Adjust replenishment rate
- Adjust pumps
- Depending on severity, clean tank and replace solution
- Depending on severity, dump bleach and/or fixer, clean tank, and replace solution

**Visual Appearance**

- Chart W
- Dark Film—Dark Images

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VISUAL PROBLEM

Light overall

- Film fogged by light before processing

- First developer too concentrated, or over-replenished, or starter omitted in preparation of working solution

- First developer contaminated with color developer

- First developer contaminated with fixer

Light overall and blue

Variable low density

Inconsistencies in time, temperature, agitation, or replenishment of first developer

CHECK PROBABLE CAUSE

Check time and temperature of first developer

Check for light leaks

Check mix procedures

Check machine for mechanical difficulties

VERIFY CAUSE

Adjust to specifications

Eliminate light leaks

Add starter if needed

Correct mix procedure

Correct machine problem

ELIMINATE CAUSE

Add starter if needed

Adjust to specifications

Add starter if needed

Adjust pumps

ELIMINATE SYMPTOM

Dump first developer, clean tank, and replace with fresh solution

PREVENT RECURRENCE

Check problem areas regularly
Chart Y
Visual Appearance
Film—High or Low Contrast

VISUAL PROBLEM

CHOOSE PROBABLE CAUSE

VERIFY CAUSE

ELIMINATE CAUSE

ELIMINATE SYMPTOM

PREVENT RECURRENCE

High Contrast: Sharp density gradations between highlights and shadows

- Too much first developer starter
  - Process control strip
  - Correct mix procedure
  - If not in control, dump

First developer time too long

- Check time of first developer
  - Adjust to specifications

Color developer too dilute

- Check specific gravity
  - Check topping-off procedure
  - Check mix procedure
  - Check pumps on in-line dilution system
  - Adjust to specifications
  - Correct topping-off procedure
  - Correct mix procedure
  - Adjust in-line dilution system

Add concentrate and starter

Low Contrast: Soft density gradations between highlights and shadows

- Color developer too concentrated
  - Adjust to specifications
  - Correct topping-off procedure
  - Correct mix procedure
  - Correct in-line dilution system
  - Add floating lids to processor tank when not in operation

Add water

- First developer time too short
  - Check time of first developer
  - Adjust to specifications
  - Correct mix procedure
  - Correct in-line dilution system

If you can determine the amount of starter left out of fresh tank, add that amount to tank

Contrast Problems

Check problem areas regularly

- Too little first developer starter
  - Check mix procedure
  - Correct mix procedure

Add water

Chart Y
Visual Appearance
Film—High or Low Contrast