Monitoring Process RA-4 for Silver-Halide Digital Printers

Photographic Systems Management involves using a comprehensive quality control program to ensure the quality of production in your lab. Quality control includes the use of objective and subjective standards to verify the performance of your photographic printers and processors.

Subjective standards are perceived, or agreed-on preferences, such as a visual review of the color and density of prints.

Objective standards are measurable and recordable, such as the results of a printer balance test, the process time and temperature of chemical solutions in your processor, and the control plot from processed control strips.

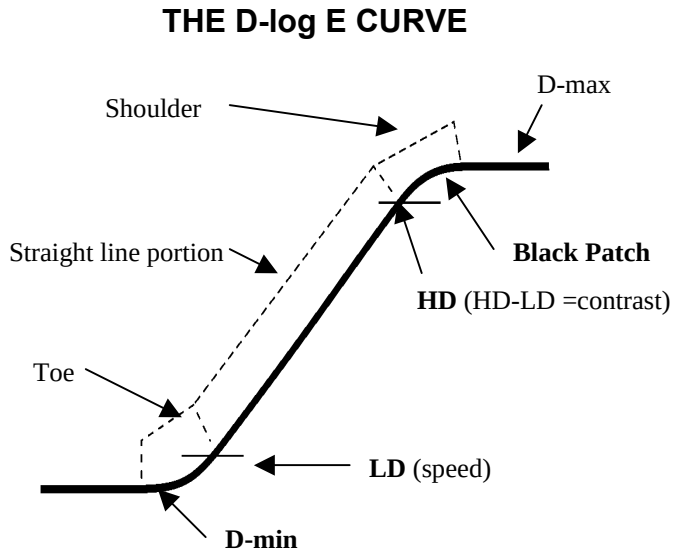
UNDERSTANDING SENSITOMETRY

The key to a comprehensive quality control program involves processing pre-exposed control strips which are read on a densitometer to determine if the photographic activity of your process is within preset sensitometric limits

Sensitometry is the science of measuring the response of photographic materials to light exposure and processing conditions. It is expressed in a graphic plot called a D-log E curve (see figure 1), which is a representation of the photographic materials response in density to a specific amount of light exposure. The photographic process can have a large effect on this density, and should be controlled to tight parameters to insure that processing variability does not cause changes in the response of the photographic paper or display material to the exposure it receives in your printer.

Compared to optical printers, digital photographic printers using laser and LED exposure systems calibrate on several points along the D-log E curve. Because of this, many labs have come to the false belief that process control is no longer important since the printer will adjust itself to any process condition. However, this is not the situation. Digital printers require even tighter process control to balance and function properly.

Figure 1



Note: Control strip control points in bold.

DIFFERENCES BETWEEN OPTICAL AND DIGITAL PRINTER BALANCE PROCEDURES

There are two major differences between optical and digital printer balancing procedures. Optical printers typically are balanced on one density point; a gray target on a standard portrait (often known as a “Shirley”) negative. A typical balance is approximately 0.80 red, 0.80 green, and 0.80 blue. Digital printers typically balance on multiple density points ranging from just above the D-min of the paper to the D-max. Because of these multiple balance points, the printer can adjust for a straight line response if the process varies from normal aim through most of the density range.

While this multiple point balance will compensate for small process shifts, it cannot correct for gross errors in the process. A major difficulty with balancing digital printers is the inability to complete the balance routine if the printer is unable to achieve its D-max aim. Without effective process control through the use of Kodak control strips, you will not know if the balance difficulty is related to an out of control process, a mechanical printer failure, or a computer/software glitch. Proactive process monitoring through the use of Kodak control strips enables you to know your printer is being properly balanced and production is going through an in-control process.

KODAK CONTROL STRIPS, PROCESS RA-4

These products are offered worldwide. They are available from your usual supplier of KODAK Products. Catalog numbers are as follows:

If you are using KODAK PROFESSIONAL ENDURA Papers and Display Materials, use KODAK PROFESSIONAL Pro Strips Color Negative Paper Control Strips, Process RA-4, to control your process.

CAT 129 8587, box of 50 strips

If you are using KODAK EDGE or ROYAL Papers, use KODAK Control Strips, Process RA-4, to control your process. These strips are available in the following sizes:

CAT 828 2170, box of 50 strips
CAT 898 2746, box of 25 strips
CAT 801 0126, box of 5 strips
CAT 130 4690, box of 25, extended length

USING THE "VISUAL PROCESS CONTROL GUIDE" TO TROUBLESHOOT PROCESS RA-4

If your Process RA-4 control chart indicates an out-of-control position, you may use the "Visual Process Control Guide" (see figure 2) to investigate potential causes and apply corrective action.

First check for operational errors:

- Make sure the control strip code matches the reference strip code.
- Calibrate the densitometer.
- Recheck the control strip aims and verify the correction factors.
- Verify the problem by processing a second control strip.
- Determine if any recent processor maintenance could have caused a problem.
- Use an accurate thermometer to verify that the developer and other solution temperatures are correct.

Match your plots to the "Visual Process Control Guide" to identify your problem:

- Match your control plots to the examples given on the "Visual Process Control Guide." Compare only one plot parameter at a time (BP, HD-LD, LD, D-min). Note that the patterns of the red, green, and blue plot deviations can be an indicator of different problems.
- Write down the problems indicated by each parameter for the plots that are out of control. Consider that you may have more than one problem occurring at the same time.
- Consider each potential cause of the out-of-control condition, and verify the operational conditions of the processor.

When you have determined the most likely cause(s) of the out-of-control condition, take corrective action to eliminate the symptom of the problem. Verify the corrective action was successful by processing another control strip.

Corrective Action and Prescriptions

- **The Yellow Patch** monitors the performance of the bleach-fix solution for **retained silver**. A bleach-fix solution that is underreplenished or diluted will not efficiently remove silver in the paper, leaving retained silver in higher density areas. The yellow patch is not plotted on a control chart; it is meant to be a visual reference only. Compare the yellow patch on a processed control strip with the yellow patch on the reference strip. If the processed control strip yellow patch appears brown or less saturated in color, or "muddy" compared to the reference, you may have retained silver. You can confirm retained silver by the following test:
  1. Take your processed control strip and process it again through your processor in order to re-bleach-fix the control strip.
  2. Compare the yellow on the re-processed control strip to the yellow patch on the reference strip. If re-bleach-fixing has improved the yellow patch on the re-processed strip, then you have confirmed a retained silver problem.

  Prescriptions:

  — Replace bleach-fix tank with fresh bleach-fix tank solution.

  — Also, recalibrate the replenishment pumps for the bleach-fix replenisher.

- **The Black Patch** monitors the performance of the developer for activity and contamination. There is no upper control limit for Black Patch. If the Black Patch plots are low, then it could be an indication of low developer activity due to underreplenishment or severe oxidation. If the blue Black Patch is very low and separated from the red and green plots, it could be a sign of developer contamination. See prescriptions listed under the **LD** parameter.
- **The HD-LD (Contrast)** is usually a very steady plot parameter that is unresponsive to most process problems. However, it can help monitor developer activity problems due to **agitation or oxidation.** If developer tank solution is underagitated, the plots will be low. If developer tank solution is slightly oxidized, the plots will be high. If the developer becomes extremely oxidized, the plots will be low. If the solution is extremely out of control by more than 0.15 density units over or under aim, drain and replace the developer tank solution. If the plots are less than 0.15 density units over or under aim, a prescription can be risked.

  Prescriptions:

  — **Underagitation:** call service representative to fix agitation pump on processor.

  — **Oxidation:** check for air bubbles in developer tank, call service technician if seen.

- **The LD (Speed)** monitors the developer activity. **Speed** is primary indicator of developer time, temperature, and especially developer replenishment rate. For time that is too long, temperature too high, or overreplenishment, the LD plots will be high. For time too short, temperature too low, or underreplenishment, the LD plots will be low. Check the temperature of the developer, adjust as necessary to bring back into specification (38.5°C +/-0.3). If the plots are extremely out of control, by more than 0.15 density units over or under aim, drain and replace the developer. If the plots are less than 0.15 density units from aim, a prescription can be risked.

  Note: If the red LD is very high and/or the green LD is very low and they are split from the blue LD, it may be caused by developer contaminated with bleach-fix. In this case, the developer must be drained and replaced with fresh developer tank solution. Make sure the tank is cleaned and thoroughly flushed with water to remove all contaminated developer from the tank and circulation system.

  Prescriptions:

  — For **high LD** plots:

  Overreplenishment: Remove a volume of developer solution equal to 10% of the amount in the working tank, and replace with water. Repeat until it's in control.

  — For **low LD** plots:

  Underreplenishment: Remove a volume of developer solution equal to 1/3 of the amount in the working tank, and replace with fresh developer tank solution.

- **D-min (Stain)** monitors the whiteness of the unexposed paper. An increase in the D-min plot can indicate oxidation or contamination problems in the developer, or a problem in the super rinse when the solution is dirty or has biological growth residue.

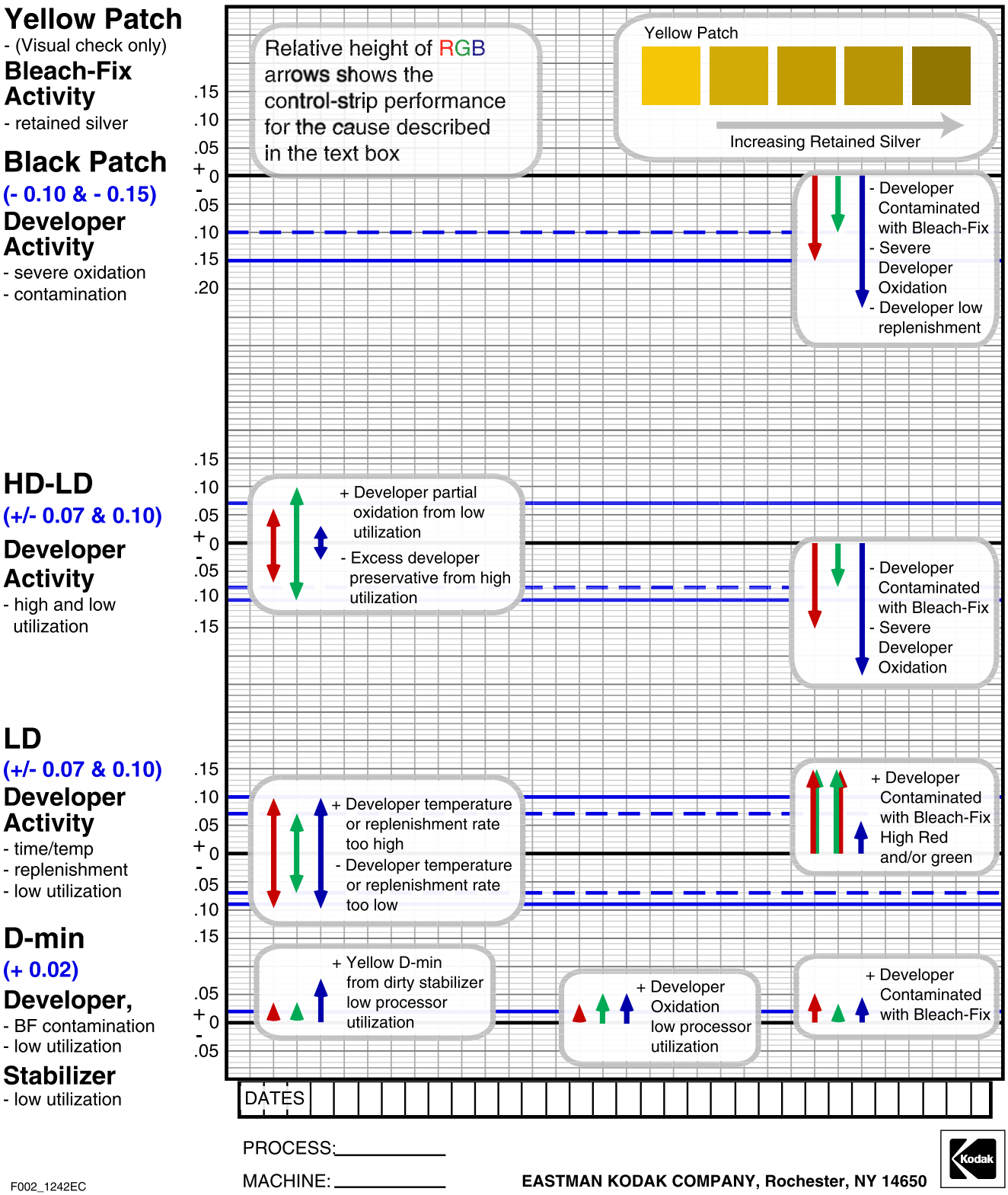
  Prescriptions:

  — For a high **D-min** on the paper caused by an oxidized or contaminated developer, replace developer tank solution with fresh developer tank solution.

  — For a high **D-min** on the paper caused by dirty stabilizer or biological growth in the stabilizer tanks and racks, clean the stabilizer tanks and replace the solution with water and KODAK Rinse Tablets.

Figure 2

Process RA-4
Visual Process Control Guide



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