

STANDARD OPERATING PROCEDURE

C-41 Color Negative Film Development — Bellini 3-Bath Kit, Daylight Tank

Document No.	Revision	Effective Date	Owner
SOP-FILM-002	B	10/21/2026	Harold Chun

1. Purpose

Defines the required method for developing C-41 color negative roll film with the Bellini C-41 three-bath kit (developer, bleach, fixer) so that every roll is processed within temperature and time tolerances, chemistry is tracked to capacity, and negatives meet quality acceptance criteria without harm to the operator or the environment.

2. Scope

Applies to C-41 color negative 35mm and 120 roll film processed by hand in a daylight tank using a sous-vide water bath for temperature control. Excludes black-and-white and E-6 processes, push/pull processing, and two-bath (blix) kits.

3. Responsibilities

- Operator: performs the procedure as written, records each run in the Process Log (Section 11), and stops work if any parameter falls outside tolerance.
- Process owner: maintains this SOP, approves deviations, tracks chemistry capacity, and reviews Process Logs for recurring defects.

4. Definitions

- Critical control point: a step where a deviation directly causes a defect. In C-41, developer temperature and developer time are the critical control points.
- Capacity compensation: extending developer time as the reused developer becomes exhausted, based on the number of rolls already processed.
- Bleach: converts developed metallic silver back to silver halide so the fixer can remove it, leaving only the dye image.
- Stabilizer: final bath that protects the negative and promotes even drying.

5. Safety and PPE

C-41 chemistry can irritate skin, eyes, and airways. The color developing agent is a known skin sensitizer. Read the Safety Data Sheet (SDS) for each Bellini component before first use.

Hazard	Control	Required PPE
Skin contact with developer, bleach, fixer, or stabilizer	Gloves on whenever handling chemistry; rinse spills immediately with water	Nitrile gloves
Splash to eyes during mixing or pouring	Pour at a low height; keep tank capped during agitation	Safety glasses
Vapor from bleach, fixer, and stabilizer	Work in a ventilated room; cap bottles when not pouring	—
Electrical hazard: sous-vide and water bath	Keep cords and outlets away from the water bath; dry hands before touching controls	—
Ingestion / cross-contamination	No food or drink in work area; dedicated, labeled vessels per chemical	—

Stop work and rinse affected skin or eyes with running water for at least 15 minutes if exposure occurs. Follow the SDS first-aid section.

6. Equipment and Materials

Equipment	Chemistry (Bellini C-41 kit)
Daylight development tank and reels (e.g., Paterson tank and reels)	Developer, mixed per kit instructions
Changing bag or fully dark room	Bleach, pre-mixed in the kit
Sous-vide circulator and water bath container	Fixer, mixed per kit instructions
Independent thermometer (± 0.2 °C accuracy)	Stabilizer, mixed per kit instructions
Labeled storage bottles for each chemical	Deionized (DI) water to mix developer, fixer, and stabilizer
Four 1,000 mL graduated cylinders	Labeled waste containers (Section 10)
Timer; scissors; film leader retriever or cassette opener; film clips; dust-free drying area	

7. Pre-Process Setup

1. Check the Process Log for the current kit's roll count and the developer mix date. Look up the developer time in Table 1, and run the activity checks in Section 7.1 if the chemistry is past its check point. Record film stock, roll count, and planned developer time before starting.
2. Set the sous-vide to 39.0 °C (102.2 °F) to account for heat loss through the storage bottles, and place the developer, bleach, fixer, and rinse water bottles in the bath.
3. Wait until the developer reaches 38.0 °C $\pm$ 0.2 °C, confirmed with the independent thermometer, not the sous-vide display. Bleach and fixer must be within 32–38 °C.
4. Pre-measure each chemical into its labeled graduated cylinder before starting: 290 mL per 35mm reel or 500 mL per 120 reel.
5. Lay out reels, tank, and scissors. For 35mm with a leader retriever, complete Step 6 first, then place the started reel and film in the changing bag. Verify the bag has no light leaks before proceeding.

Table 1. Developer time by kit usage

Roll number in this developer batch	Developer time at 38.0 °C
Rolls 1–3	3:15
Rolls 4–6	3:30
Rolls 7–9	3:45
Rolls 10–12	4:00
Rolls 13+ (beyond rated capacity)	Outside the kit's rated capacity (off-spec). Continue adding 15 s every 3 rolls (13–15 = 4:15, 16–18 = 4:30) until the developer is fully exhausted. Expect color casts from partial exhaustion; record each roll as a deviation in the Process Log.

7.1 Chemistry Shelf Life and Activity Checks

Mixed chemistry degrades with time and exposure to air, even when it has not reached its roll capacity. Write the mix date on every bottle label and in the Process Log. Store working solutions in full, tightly capped bottles with as little air as possible, in a cool, dark place.

Working solution	Typical shelf life*	Activity check
Developer	About 5 weeks	Developer snip test before each run once the mix is 4 weeks old, or anytime the developer looks discolored or negatives come out thin
Bleach	About 6 months	Replace at kit capacity or shelf life
Fixer	About 6 months	Fixer clearing test once the mix is 3 months old, or anytime negatives look milky

Working solution	Typical shelf life*	Activity check
Stabilizer	About 6 months	Replace at shelf life

*Typical figures for the Bellini kit; confirm against the kit instructions. Airtight storage extends shelf life.

Developer snip test

- Cut a 2–3 cm snip from a film leader. The leader has already been exposed to light.
- Drop it into a small sample of developer at 38 °C.
- Fresh developer turns the snip dark within about 3 minutes. If it is not dark after 10 minutes, discard the developer.

A passing snip test shows the developer is still active, not that it is on-spec. Partially exhausted developer can still cause color shifts.

Fixer clearing test

- Drop an unprocessed snip of film leader into a small sample of fixer and start a timer.
- Agitate gently and note the time until the snip turns clear (the clearing time).
- Fixing time should be at least twice the clearing time. If the clearing time is more than half the 1:30 fix time, or has doubled compared with fresh fixer, replace the fixer.

8. Procedure

8.1 Load Film

- 35mm, in normal light: pull out the film leader with a leader retriever, cut it square with scissors, and feed about 2 inches of film onto the reel, just past the ball bearings. If using a cassette opener, this will need to be done in total darkness.
- 35mm, in total darkness: wind the rest of the film onto the reel, then cut the film free from the cassette spool.
- 120, in total darkness: break the spool seal, unroll the backing paper, separate the film from the backing paper, remove the tape on the film, and load it onto the reel.
- Handle film by the edges only. Film must not touch adjacent wraps on the reel.
- Place loaded reels in the tank, insert the center column, and seal the lid before restoring light.

8.2 Pre-Heat Film

- Fill the loaded tank with water at 38 °C to bring the tank and film to temperature. After 3 minutes, discard the water.

8.3 Develop (critical control point)

- Pour developer into the tank in one continuous pour in under 5 seconds. Once poured, start the timer.
- Tap the tank on the counter to dislodge air bubbles.
- Agitate: invert continuously for the first 15 seconds, then 4 inversions every 30 seconds. Return the tank to the water bath between agitations to hold temperature.
- When the developer time elapses, pour the developer back into its bottle in under 10 seconds. Record the roll count against this developer.

8.4 Bleach

- Fill the tank with bleach and agitate continuously for 0:45. Return bleach to its labeled bottle.

8.5 Fix

- Fill the tank with fixer and agitate continuously for the first 15 seconds, then 4 inversions every 30 seconds for 1:30. Return fixer to its labeled bottle.

8.6 Wash

- Wash with running water at 32–39 °C for 3:00, or with 7 fill-and-dump cycles.

8.7 Stabilize

- Remove the lid and center column.
- Fill the tank with stabilizer and let film soak for 1:00. Do not rinse after stabilizer.

8.8 Dry

21. Remove film from the reel, attach a clip to each end, and hang in a dust-free area. Do not wipe the emulsion side.
22. Allow to dry fully for at least 1 hour before scanning, cutting into strips, and sleeving.

9. Quality Inspection

Inspect every roll on a light source once dry. Record results in the Process Log. Any defect marked "Hold" requires process-owner review before the next run.

Observation	Likely cause	Action
Orange-base negatives with readable edge markings and frame numbers	Process within tolerance	Accept
Thin negatives; faint edge markings	Developer temperature low, developer time too short, or developer past capacity	Hold; verify thermometer reading, Table 1 time, and roll count
Dense negatives; strong color cast	Developer temperature high or time too long	Hold; verify temperature and time
Clear film, no edge markings	Developer step skipped or wrong bottle poured first	Hold; verify chemical order and bottle labels
Dark, dull, or muddy negatives	Incomplete bleaching (exhausted bleach or short bleach time)	Re-bleach, re-fix, re-wash, re-stabilize
Milky or opaque areas	Incomplete fixing	Re-fix, re-wash, re-stabilize; check fixer capacity
Uneven density, streaks near sprocket holes	Inconsistent or excessive agitation	Hold; retrain on agitation pattern
Water spots or residue	Stabilizer skipped or diluted incorrectly	Re-wash and re-stabilize

10. Waste Handling and Disposal

- Exhausted bleach and fixer contain dissolved metals, including silver, and must not be poured down the drain. Bleach and fixer may be combined in one labeled container marked "Bleach/fix waste: contains silver." Take it to a local household hazardous waste facility.
- Collect exhausted developer in its own labeled waste container and take it to a local household hazardous waste facility. Never mix developer with bleach/fix waste.
- Rinse all vessels and the tank thoroughly after each run.

11. Records

Each run is recorded in the Process Log with: date, operator, film stock, kit batch, mix date, roll count, measured developer temperature, developer time, inspection result, and any deviations.

12. Revision History

Revision	Date	Description
A	10/15/2026	Initial release
B	10/21/2026	Added chemistry shelf life and activity checks (Section 7.1); updated capacity guidance beyond 12 rolls; updated waste segregation (bleach and fixer may be combined)