

solution. It is diluted just before use and the necessary quantity of CD-4 then added as a solid or from 20% solution:

Calgon or sodium tripolyphosphate	20.0g
Sodium sulphite (anhydrous)	20.0g
Sodium or potassium hydrogen sulphate	70.0g
Potassium carbonate (anhydrous)	300.0g
Hydroxylamine sulphate	30.0g
Potassium bromide	18.0g
Water to make	1000.0ml

In use take 100ml per litre working solution.

Capacity (1 litre) and shelf life of fresh solutions

Solution	Keeping	110/20ex	126/20ex	Capacity 135 120 36ex	dm ³ approx
Colour developer without CD-4	6 weeks	—	—	—	—
Colour developer with CD-4	1 month	30	12	5	6 30
Bleach	8-13 weeks	120	45	20	24 100-120
Fixer	8-12 weeks	60	22	10	12 60
Stabiliser	1 year	use once only	—	—	—
Stop bath	1 year	use once only	—	—	—

Notes

1 Partially used solutions have a 30-50% lower shelf life, depending on the actual storage conditions (darkness, well-stoppered bottle, temperature 14-20°C).

2 Work whenever possible with fresh solutions to ensure optimum consistency of results. However, for 110 format film, Kodak advise the division of 1 litre of developer into two 550ml quantities. This enables films to be developed in batches of 3, and 5 or 6 batches can be processed before throwing the developer away. If this is done, processing times should be modified according to the following table.

Development time (min/sec)

Film	No of films developed at once	1st	2nd	3rd	4th	5th	6th	Total films (on 500ml)
110/12ex	3	3 15	3 22	3 30	3 37	3 45	—	15
110/12ex	3	3 15	3 20	3 26	3 31	3 37	3 43	18

3 It is desirable to keep the bleach solution, unlike others, in a half full container. It should be shaken vigorously after use for about 10sec to reoxidise the ferrous complex Fe²⁺ (formed during bleaching) to the ferric complex Fe³⁺, so that its activity can be maintained. Replenishment is not advisable in amateur usage and the solution should therefore be thrown away after the indicated number of films has been processed.

NB1 The C-41 colour developer is also suitable for processing Ektacolor 78RC Paper, adding 45ml/l benzyl alcohol.

NB2 Instead of separate Bleach and Fixing baths, the use of a combined bleach/fix is possible. That given for 78RC paper is suitable (4min): pH 5.8-6.2.

OTHER MAJOR MANUFACTURERS' MATERIALS COMPATIBLE WITH C-41 PROCESSING:

Acfacolor CNS-400

Sakuracolor IF and Sakuracolor II 400

Fujicolor F-11 and F-11 400

Turacolor 11

3M Color Print

GAF Color Print

Valcolor 11

C-22 process

Formulae

Colour developer (pH:10.6-10.7)

Calgon or sodium tripolyphosphate	2.0g
Benzyl alcohol	5.0ml
or benzyl alcohol (solution 35%) (see E-4)	15.0ml
Sodium metaborate (crystalline) or Kodak	85.0g
Sodium sulphite (anhydrous)	2.0g
Potassium bromide	1.6g
CD3	5.3g
Water to	1000.0ml

Stop bath (pH:4.3-4.7)

Glacial acetic acid	20.0ml
Sodium sulphite (anhydrous)	10.0g
Water to	1000.0ml

Hardener (pH:10.4-10.8)

Formaldehyde (35-40% solution)	20.0ml
Sodium carbonate (anhydrous) †	10.0g
Water to	1000.0ml

Bleach (pH:6.6-7.0) [See also formula E-3/4 bleach, which acts faster]

Potassium nitrate (crystalline)	25.0g
Potassium ferricyanide	20.0g
Potassium bromide	8.0g
Boric acid	5.0g
Disodium tetraborate	1.0g
Water to	1000.0ml

Fixer (pH:4.4-4.6)

Ammonium thiosulphate (crystalline)	120.0g
Potassium metabisulphite	20.0g
Water to	1000.0ml

Keeping properties and working capacities

Solution	Keeping time	Working capacity per litre
		Roll films 35mm Sheet film (120 or 620/120 exp) 4 x 5 in

Colour developer:			
with CD3	2 weeks	6-8	8-10 25
without CD3	6 months	8-10	8-10 25
Stop bath	indefinite	6-8	8-10 25
Hardener	1 year	12-16	16-20 50
Bleach	6 months	16-16	16-20 50
Fixer	6 months	16-16	16-20 50

Procedure

The several stages are those specified by Kodak:

1 Colour developer	13min 75±0.5°F
2 Stop bath	4min 68-76°F
3 Hardener	4min 68-76°F
Normal room lighting may be resumed	
4 Wash	4min 68-76°F
5 Bleach	6min 68-76°F
6 Wash	4min 68-76°F
7 Fixer	8min 68-76°F
8 Final wash	8min 68-76°F
Total	51min

Notes

A recommended agitation is continuous for the first 15 sec, then two periods of 5sec every minute.

B For electronic flash exposures, it was established that the colour characteristics of the negative are often improved by increasing the development time by 2min to 16min.

C Films are transferred from the colour developer direct to the stop bath, taking care to carry as little developer over as possible. However, it was confirmed that a brief rinse (20sec) does no harm and extends the life of the stop bath. The same applies to transferring the film from the stop bath to the hardener.

D For sheet films after every three 4 x 5in films the time of development should be increased by 35-45sec. For example:

Film number:	1-3	4-6	7-9	10-12	etc
Minutes:	14	14½	15	16	16½

For maximum uniformity of results it is advisable to develop at least 2-9 films together (by the use of suitable dishes) and to use considerable quantities – 5l or more – of solution. In this case an increase of developing time will be necessary only every 12-15 4 x 5in films.

E Here, as in all photographic processing, scrupulous cleanliness throughout is essential. Care should be taken to avoid contamination of one solution by another except in the case of the stop bath and hardener, where as officially prescribed by Kodak the film passes straight from the developer into the stop bath and thence into the hardener without any intermediate rinse. It is, however, as well to drain films before immersing them in that solution. It is in fact possible to increase considerably the life of the stop bath and hardener by giving the film a quick rinse (5sec) in water between solutions. For our part we prefer this method which better conforms with our own niceties of practice.

F The pH-value of the solutions may be adjusted if need be by varying the buffer proportions (disodium hydrogen orthophosphate, disodium tetrachlorate, boric acid).

G It is recommended that the CD3 be added immediately before use; this greatly extends the life of the stock solution. A practical procedure is to make up a 20% stock solution of CD3, the requisite quantity being abstracted with a pipette immediately before use.

Potassium metabisulphite	5 Og
CD3	20 Og
Water (30°C) to	100 Oml

H By adjusting the proportion of potassium bromide in the colour developer, contrast can be controlled to an appreciable degree: within limits a higher bromide content increases contrast. It can be reduced to as little as 1g/l, which at the same time gives a gain in emulsion speed of about ½ stop but with the risk of increasing colour fog (depensing upon the emulsion).

I For roll films and 35mm films the time of development should be increased by 30-45sec for each film developed. Sheet films: the time of development should be increased by 30-45sec for every 5-6, 4 x 5in films.

Other manufacturers' materials designed for C-22 processing
The following major manufacturers' materials may be processed by the C-22 process:

Fujicolor N100 and NK
GAF (Anso) Color Print Film
Sakuracolor N100

3M Color Print Film

In addition many 'brand-name' films are designed for C-22 processing: Brilliant; FK Color; Inter Color; Krantzcolor N21, N19, Negra Color; Oga Color; Prinz Color; Revue Color; Sears Color; Tura Color; Cornet; Mr Friendlycolor; Valcolor; Twin Pix; David Jones Color; Color Neg Film ASA80; Global CN100; Shell; Ferrania Color Film; Herbert Smalls Extracolor; AA; Certified Color Print; Titan; Palcolor; Extra Spool; Milverson; Paragon; Thrifty Color Neg; Focal; Porst Color; Tele Color; Ring Foto; Revue Color 2000; Trifca Mk VI (FCA); Fotop Colour; Color MN19 (FotoKemika Yugoslavia); Directacolor; Picture Pac Color Picture; Montgomery Ward Color Print ASA80; Berkeleycolor Negative Film ASA80; Myercolor GN100; John Martins Color ASA80; Hanimex Vistacolor ASA100; Color Neg Film Cartridge/Kassette ASA84; Boots Color Print. The following 110-format materials are also processed by the Kodak C-22 process: Boots Color Print; Revue Color 2000; Pacific Prestige; Prinz Color; Trifca; Gaf; AA.

Colour Print Papers

Agfacolor MCN 310/317/319 Type 4 (RC resin coated)

Introduction

The characteristics of these colour papers are adapted to the presence of the masks in Agfacolor CNS. The manufacturers recommend that the paper should if possible be stored at a temperature below 10°C (in a refrigerator) and that the relative humidity should not exceed 60%. In view of the high sensitivity of the paper, it should not be exposed for more than 2min to the light of an Agfa-Gevaert 08 safelight, using a 15W lamp at a minimum distance of 30in.

Formulae

The formulae are as specified by Agfa. The developing agent recommended by the manufacturers is 4-(N- ω -sulpho-n-butyl-N-n-butylamino)-aniline (Ac 60). This substance is not commercially available but may be replaced by hydroxyethylthylparaphenylenediamine (sulphate): the use of one or other of these agents requires slight modification of filter values. Diethylparaphenylenediamine sulphate is also very suitable and gives results which are close to those obtained with Ac 60, without modification of the developing time.

Colour developer (pH:10.8-11.0)

Calgon, sodium hexametaphosphate or tripolyphosphate	1.4g
Hydroxylamine sulphate	2.7g
Sodium sulphite (anhydrous)	2.7g
Sodium bromide	0.7g
Potassium carbonate	67.0g

Add, some hours before use:

Ac 60 (Agfa) or	4.0g
T32 or Droxochrome or S5 or	3.3g
diethylparaphenylenediamine sulphate	2.0g
Water to	1000.0ml

Bleach-fixer (pH:7.4-7.7)

EDTA Na ₄	25.0g
Disodium tetraborate (crystalline)	30.0g
EDTA NaFe	30.0g
Potassium dihydrogen orthophosphate (anhydrous)	15.0g
Sodium sulphite (anhydrous)	2.0g
Thiosemicarbazide*	3.0g
Sodium thiosulphate (crystalline)	290.0g
Water to	1000.0ml

*Provided replenishment of solutions is carried out, this substance may be omitted.

Stabiliser (pH:6.5-8.0)

Brightening agent	4.0g
Sodium acetate (3H ₂ O)	3.0g
EDTA Na ₄	2.0g
Formaldehyde (30% solution)	80.0ml
Water to	1000.0ml
Brightening agents: An industrial product such as: Leucophore 1R (Sandoz)	
Blancophore BBU, BUP, BP (Bayer)	