

# Developer 40-H

**Developer 40-H** is a carbonate based, liquid developer concentrate for developing fully or semi aqueous dry films and/or liquid photo-imageable solder masks. **Developer 40-H** contains 640 g/L of potassium carbonate, a chemical stabilizer, and optional cleaners. Unlike conventional stabilizers, the Developer 40-H stabilizers do not significantly increase the pH of the solution, and thus can be employed at concentrations high enough to obtain 15-20% more throughput through the same volume of chemistry.

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This economical concentrate can also be employed in manual or automated replenishment systems. When used in combination with a Auto Controller and D3 Dosing Device. Developer baths may be operated for 4-20 weeks continuously and without dumping (depending upon throughput). The Auto Controller will automatically make additions of developer concentrate and water, maintaining the pH at +/- 0.02 pH units and the carbonate concentration at +/- 0.03% by weight, resulting in predictable developing quality without adjusting the conveyor speed.

## Features & Benefits

1. Developer 40-H is formulated with a unique hard water scale inhibitor which will not complex or chelate heavy metals during waste treatment, nor dull fused solder during LPI solder mask processing.
2. Developer 40-H PC-40 is compatible with virtually all type of aqueous and semi aqueous dry films and LPI solder masks.
3. Developer 40-H is stabilized, improving process consistency and improving bath life by 20%.

## Physical Data

Physical state	Liquid
Appearance	Transparent solution
Odor	Odorless
Stability	Stable
Freeze stability	DO NOT FREEZE (17° F)
Specific gravity	1.5
pH	11

## Equipment Requirements

Tanks	Tanks should be constructed of polypropylene, polyethylene, PVC or CPVC.
Heaters	Quartz, titanium, stainless steel, or teflon encased steel.
Racks	Racks and/or baskets should be polyethylene, polypropylene, stainless steel or plastisol coated steel.
Cooling Coils	Cooling coils should be constructed of polyethylene, polypropylene, teflon, stainless steel or plastisol coated steel.
Ventilation	Recommended
Agitation	Spray processing may require the addition of anti-foam. A nonpetroleum based anti-foam such as Hubbard Hall's ANTI/Foam 1200-NS is recommended.
Filtration	Continuous filtration is recommended.

## Product Make-up

**Developer 40-H** must be diluted prior to use. Please refer to the following chart on recommended concentrations.

Per 100-gallon Bath:

Type of Photopolymer	PC-40 (gal)	PC-10 (gal)	Water (gal)
fully aqueous dry film	1.6	----	98.4
semi-aqueous dry film	1.8	4.0	94.2
LPIsm	1.7	----	98.3

NOTE: Always follow manufacturers recommendation regarding the carbonate concentration suitable for developing a specific photopolymer. The above data is to be used as a guide only.

The following procedure is recommended for mixing the bath.

1. Thoroughly rinse the tank and inspect for cleanliness paying special attention to the heaters and heater sheathings, and cooling coils. (If necessary, employ EQUIPMENT/Cleaner 10 to thoroughly clean the tank.)

2. Fill the tank half full with deionized water. Add **Developer 40-H** concentrate such that after final dilution the concentration desired is obtained. Fill the tank to operating level with deionized water.
3. Measure the potassium carbonate concentration by employing the test method described in this data sheet.
4. Turn on heaters and verify temperature with a thermometer.

NOTE 1: To assure optimum performance, it is recommended deionized or distilled water be used to dilute **Developer 40-H**.

NOTE 2: PC-40 is a concentrated mixture of alkali materials. Always employ the proper safety equipment when working with this product including safety goggles, rubber boots, gloves, and apron.

## Operating parameters

Developer 40-H should be operated within the specifications of your dry film and/or LPI solder mask supplier. Typically, these specifications are as follows:

potassium carbonate concentration	0.85 - 1.10% by weight
temperature	85 - 110 F
dwel time	30 - 150 seconds (to maintain 50% "break")

## Control and Replenishment

### BATCH DUMP PROCESSING

Make-up a new bath at the desired concentration and measure the pH. The pH of a new bath should be 11.0 - 11.6 depending upon sump cleanliness and water quality. During operating, periodically measure the pH of the bath. The bath should be dumped when the pH drops below 10.3 pH units.

### AUTOMATED FEED AND BLEED PROCESSING

Only two variables, the pH and percent by weight (%w/w) total carbonate require control during processing. It is recommended the pH be maintained between 10.70 - 10.75. This is most effectively accomplished by employing an automated feed and bleed pH control system. AUTO/Controllers employ a simple pH controller and D3 (Developer Dosing Device) to accurately regulate the volume developer concentrate and water additions. The operation of the system is extremely simple. When the pH reaches the lower setpoint, water is allowed to pass through the D3 valve. Based upon the flow of water passing through the valve, the D3 blends Developer 40-H and water at correct ratio and delivers the solution to the processing sump. Additions are made until the pH reaches the high setpoint. **Please note, the D3 valve DOES NOT require**

**consistent water flow to function accurately (within +/- 0.03% w/w total carbonate).** It is unnecessary to dump the bath except during routine equipment maintenance, eliminating frequent bath make-ups and heat-up time. Additionally, because the pH is held constant (+/- 0.025 pH units), it is unnecessary to continually adjust conveyor speed to control the break point.

### Measuring the Percent by Weight Total Carbonate

The percent by weight (% w/w) of Developer 40-H in the working bath or diluted feed line can be calculated using the procedure below.

#### Equipment Required

Burette, 50 ml  
 Erlenmeyer flask, 250 ml  
 Pipet, 10 ml

#### Reagents Required

Methyl orange indicator  
 Hydrochloric or sulfuric acid, standardized,  
 0.10 N

#### Procedure

1. Pipet 10 ml of sample into a 250 ml Erlenmeyer flask containing approximately 50 ml of DI water.
2. Add approximately 10 drops of indicator and titrate with standardized acid from an orange to a red endpoint. Record the mls of titrant required to reach the endpoint.

#### Calculation

$$\frac{A \times B \times C}{2 \times D} = \text{g/L potassium carbonate}$$

**NOTE: The g/L total carbonate divided by 10 equals % w/w total carbonate!**

Where	A	=	volume of titrant required in ml
	B	=	N of the titrant
	C	=	M.W. potassium carbonate (138.2)
	D	=	sample volume in ml

## Safety and Handling

Developer 40-H contains a blend of alkalis. When working with Developer 40-H, always wear protective clothing including safety goggles, rubber apron, boots, and gloves. In case of eye or skin contact, flush affected area immediately with water and contact a physician if any irritation persists. It is strongly recommended contact lenses not be worn when working with chemic



## Waste Treatment

Solubilized dry film and LPI solder mask in used developer solution will contribute to the COD (chemical oxygen demand) of your waste stream. Often, spent developer solutions can be directed to final pH with no intermediate treatment. There are general guidelines which may be helpful in determining the compatibility of the developer waste stream with other waste streams in your facility. Individual users should verify the nature of spent solutions to assure compliance with local, state, and federal regulations. Contact Hubbard Hall for specific details and/or further waste treatment recommendations.

Developer 40-H Develop Concentrate is also available in the following versions:

\* Developer 40-H C: “Cleaner” to reduce anti-foam residue and hard water scale accumulation in conveyORIZED equipment.

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