

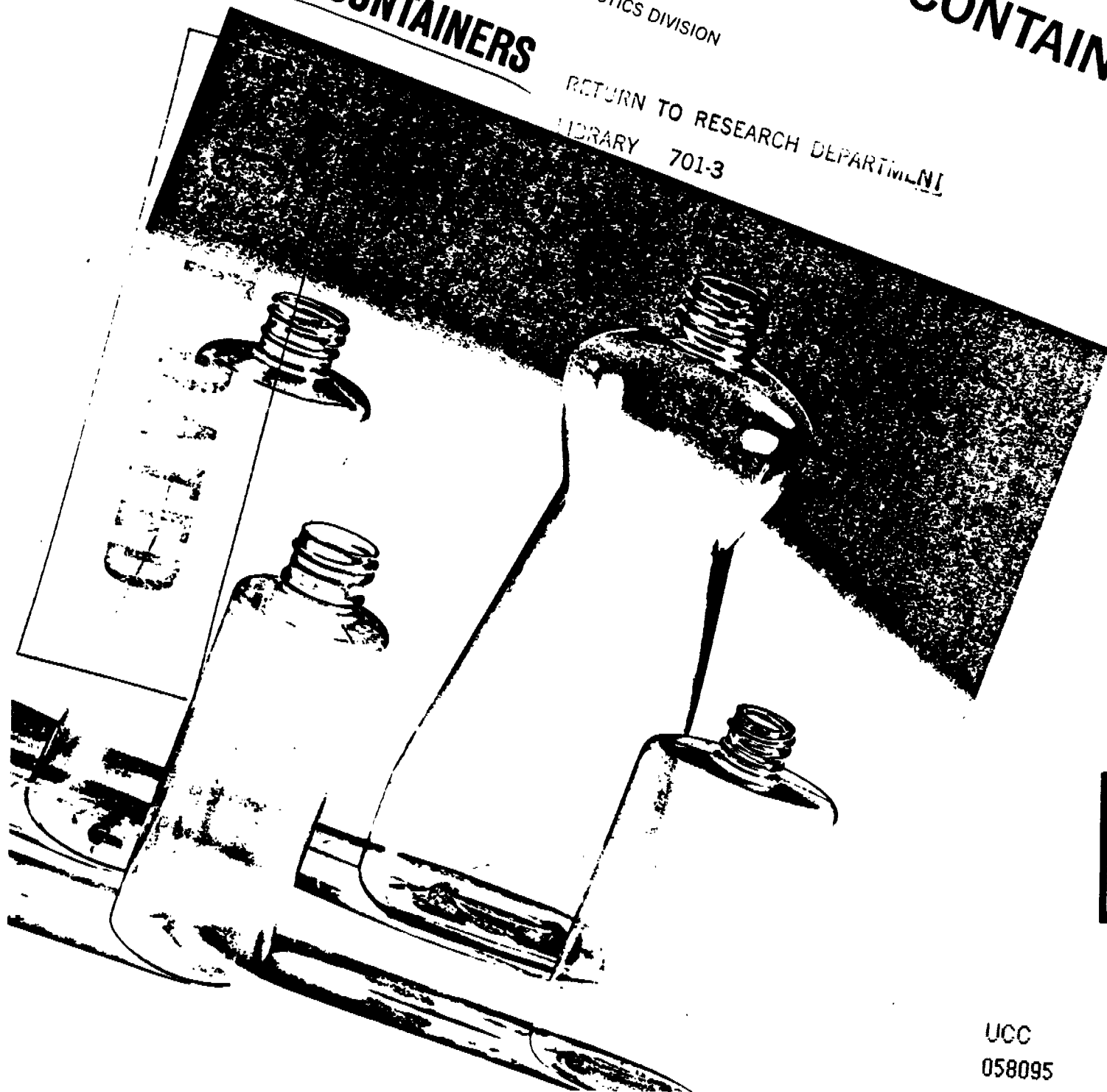


CLEAR PLASTIC CONTAINERS

UNION CARBIDE CORPORATION • PLASTICS DIVISION

PVC CONTAINERS

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PVC CONTAINERS

INTRODUCTION

UNION CARBIDE clear PVC (polyvinyl chloride) plastic containers add new versatility and sales appeal to the field of plastic packaging. The glass-like transparency plus break resistance of these PVC bottles are only a part of the story; they also provide the barrier properties and chemical resistance needed to serve entirely new plastic packaging applications.

PVC OFFERS:

- Transparency and break resistance for increased sales appeal.
 - Low oxygen permeability for preservation of oxygen sensitive toiletries and household chemicals.
 - Aroma barrier properties for the retention of dilute perfumes and essential oil flavorings.
 - Compatibility with aliphatic solvents and alcohols for successful packaging of solvent containing waxes, polishes, cleaners, and alcoholic cosmetics such as after shave lotions and hair tonics.
- Good chemical resistance. Low tendency for staining, stress cracking or attack by many corrosive products. Light weight for reduced shipping costs. Acceptable moisture barrier properties for most aqueous products. Attractive economics for food packaging. Bottles can be supplied in clear or a full range of transparent and que tints.

STAINMENT ACTERISTICS

PERMEABILITY:

CARBIDE PVC bottles show low permeability to ethanol, aliphatic and alicyclic solvents, and to water and mineral oils. Water permeability of PVC, however, is greater than that of polyethylene, but suitable for most aqueous products. Weight loss of aqueous products in 8-oz. round PVC bottles is less than two per cent per year at 75% R.H. PVC is not recommended for use with highly sensitive products. Typical data for a range of toile-

tries and household chemicals are summarized in Table I.

A low weight loss or gain does not in itself assure acceptable packageability. Many products require:

1. The exclusion of oxygen.
2. The retention of minor concentration ingredients such as essential oil flavors and odors.
3. Freedom from extraction of off-odors from the container.

UNION CARBIDE PVC performs extremely well in all of these categories.

Table II illustrates the superior barrier qualities of PVC relative to other plastic bottle materials.

The retention of dilute essential oil fragrances by PVC bottles is exceptionally good and far superior to high density polyethylene. The fragrance retention of PVC bottles containing 0.5% solutions of methyl salicylate, oil of cloves, peppermint oil and lemon oil approached that of glass after 6 weeks at 122°F. The perfumes present in many toiletries are retained to high degree after long term aging at room temperature.

The slight odor characteristics of commercial PVC bottles is dependent on the formulation ingredients. UNION CARBIDE PVC bottles have been formulated to minimize foreign odors and are suitable for most toiletries.

CHEMICAL RESISTANCE

The broad versatility of PVC bottles is largely due to their high resistance to attack by product ingredients. PVC is generally unaffected by the chemical agents listed below.

PVC is resistant to:

Water; Alcohols; Polyols; Aliphatic ethers; Mineral acids and bases; Organic acids; Vegetable and mineral oils; Aliphatic and alicyclic solvents; Turpentine; Detergents and soaps; Waxes.

PVC is not compatible with many chemicals in the groups listed below. However, dilute solutions of these chemicals are frequently packageable. Confirmation should be obtained by packaging tests. The performance of essential oils is typical. Concentrated methyl salicylate readily attacks PVC, but is completely compatible and

practically non-migrating in the dilute forms commonly used.

PVC is attacked by some:

Aromatic hydrocarbons; Ketones; Halogenated hydrocarbons; Aldehydes; Esters; Essential oils.

Some heavy duty and disinfectant cleaning products containing agents such as aromatic phenols show partial incompatibility with PVC at elevated storage temperatures. This appears as a haze or whitening of the inner container wall. In severe cases, these products can be packaged in opaque PVC bottles, or the product can be reformulated to improve compatibility with a clear container.

PVC bottles show little tendency for staining by-product coloring additives.

IMPACT STRENGTH

Impact properties of PVC bottles vary with bottle size, weight, and design. In addition to these factors, aging may also alter impact performance. The effects of time, temperature, and product environment should be determined for each application.

PVC bottles have adequate resistance to drop impact and other abusive handling. Typical impact data for 8-oz. pinch-waist cylinder bottles are:

Mean drop height—50% failure: 9 feet

Average number of six-foot drops to failure: 7

These impact properties are maintained at an acceptable level at 32°F.

HOT FILLING

UNION CARBIDE PVC bottles may be hot filled at temperatures up to about 170°F. Bottle shape, size and thickness factors determine the actual upper temperature limit. Non-cylindrical shapes are preferable because they are least likely to develop objectionable collapse after hot filling.

AREAS OF APPLICATION

Extensive laboratory tests indicate the UNION CARBIDE PVC containers are well suited for the packaging applications listed in Table III. Union Carbide's Plastics Division will gladly provide specific packageability test information of products submitted for evaluation.

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TABLE I
Typical Permeability Values for UNION CARBIDE General Purpose
and Cosmetic Grade Vinyl Bottles

Product	Projected Annual Weight Change in % ⁽¹⁾		P-Factor ⁽²⁾	
	77°F/50%RH	122°F	77°F/50%RH	122°F
Toiletries				
Hair Shampoo	-1.4	-11.6	-0.6	-4.9
Hair Tonic				
(70% alcohol)	-1.1	-5.8	-0.4	-2.1
Hand Lotion	-1.7	-13.8	-0.7	-5.5
Skin Lotion	-2.8	-17.3	-0.8	-5.6
Bath Oil	-0.1	-1.5	—	-0.5
Mineral Oil	neg.	-1.0	—	-0.3
After Shave Lotion				
(70% alcohol)	-1.3	-12.1	-0.5	-4.6
Household Products				
Dishwashing Detergent	-1.4	-11.5	-0.6	-4.8
Heavy Duty Liquid Cleaner	-1.7	-14.5	-0.7	-5.7
Detergent Ammonia	-2.0	-13.8	-0.7	-5.4
Disinfectant Cleaner A	-1.4	-12.2	-0.6	-5.2
B	-1.6	-12.9	-0.7	-5.4
Lemon Oil				
Furniture Polish	neg.	-1.1	—	-0.4
Furniture Polish				
(Naphtha base)	-1.8	-10.6	-0.6	-3.5
Liquid Car Polish				
and Cleaner	-1.8	-13.5	-0.7	-5.3
Cigarette Lighter Fluid	-0.3	-1.2	—	-0.3
Turpentine	-0.1	-0.8	—	-0.3
Motor Oil SAE 10	neg.	-1.0	—	-0.3
Varsol #1	-0.15	-0.8	—	-0.3
Ethylene Glycol	neg. ⁽³⁾	neg. ⁽³⁾	—	—
Reference				
Water	-1.7	-13.0	-0.7	-5.3

⁽¹⁾Weight change projected from six week data—8-oz. cylinder 27 grams.

⁽²⁾Permeability expressed in gms./100 in², 24 hrs./mil at conditions specified.

⁽³⁾Slight weight gain due to moisture absorption.

TABLE II
PERMEABILITY OF PLASTIC BOTTLE MATERIALS

	Water Permeability ⁽¹⁾	Oxygen ⁽²⁾
PVC Bottle Compound	2.9	14—16
Phenoxy	3.6	6
Polyethylene (0.95 density)	0.4	80—120
Polyethylene (0.92 density)	1.0	350
Polypropylene Copolymer (0.90 density)	0.7	155
Ionomer	1.6	490
Acrylic Multipolymer	11.8	19—40
Polycarbonate	11.0	185
Styrene/Acrylonitrile	14.0	65

⁽¹⁾gms./100 in², 24 hrs./mil at 100°F/90%RH—ASTM E96-63T (measured on 10-15 mil pressings)

⁽²⁾cc (STP)/100 in², 24 hrs, atm./mil

TABLE III
AREAS OF APPLICATION

Cosmetics and Toiletries:

Shampoos
Hair tonics (all types)
Wave sets and other hair preparations
After shave lotions
Colognes
Hand and body lotions and creams
Bath oils
Baby oil
Powders

Household and Industrial Products:

Light duty detergents
Heavy duty cleaners
Detergent ammonia
Disinfectant-type cleaners
Glass cleaners
Waxes and polishes (floor, auto, furniture, metal)
Photographic chemicals
Cigarette lighter fluid
Charcoal starter fluid
Turpentine
Lubricating and engine oils
Ethylene glycol anti-freeze

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