

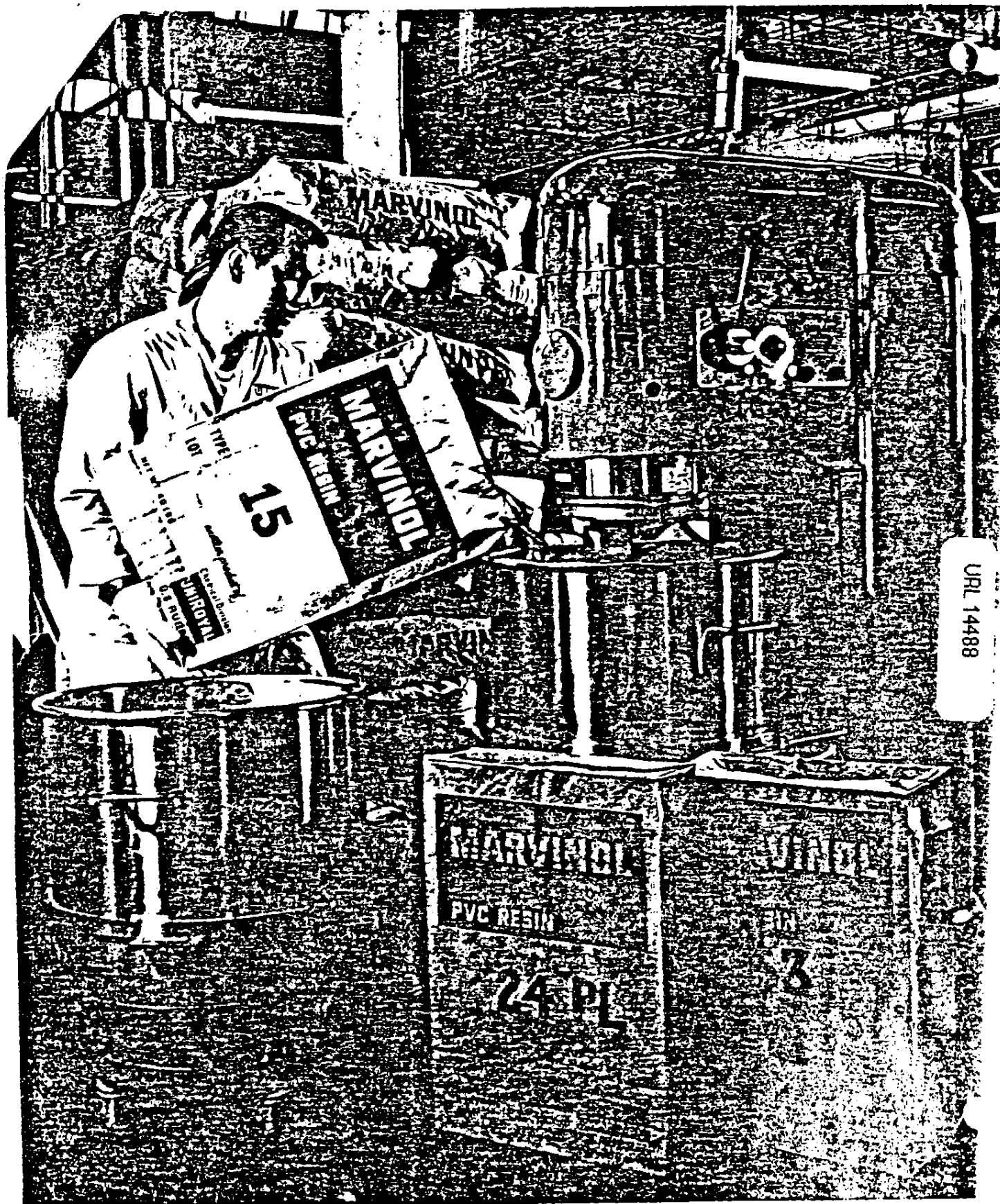
**Marvinol PVC Plastisol blending resins
reduce costs, enhance processing properties.**



URL 14487

UNIROYAL CHEMICAL

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What Marvinol[®] PVC blending resins are designed to do.

The use of PVC resins designed specifically for blending with plastisol and organosol resins has reached a position of high importance.

Although blending resins have been used for many years their use was generally confined to slush and rotational molding applications. Now blending resins have found their way into a variety of other applications as well. These include foam-cloth laminates, coated cloth, organosols for flooring, spray coating of metal and others.

Of course a major advantage in the use of such blending resins is cost reduction. Although important, this by no means is their sole function. Blending resins also provide viscosity reduction, air release enhancement, a gelation temperature adjustment capability, film dryness, gloss reduction and other features of sound technical consequence.

Three Marvinol resins have been designed for this work. These are Marvinol 10, Marvinol 15 and Mar-

vinol 24PL. Each serves a specific function as detailed in this bulletin.

In characterising blending resins the particular resin properties considered differ somewhat from those used in evaluating dispersion resins.

Typical properties of Marvinol blending resins follow:

Property	Marvinol 10	Marvinol 24PL	Marvinol 15
Polymer	PVC	PVC	PVC
Specific viscosity (1)	0.52	0.30	0.30
ASTM oil absorption (2)	0.63	0.50	0.50
Bulk density, lbs/ft ³	24	32	32
Specific gravity	1.40	1.40	1.40

Screen analysis % (not cumulative)

70 mesh	trace	trace	-
100 mesh	1	2	trace
140 mesh	5	7	1
200 mesh	20	25	6

(1) ASTM-D 1243-60; (2) ASTM D 281-31.

● UNIROYAL registered trademark for its polyvinyl chloride, resins and compounds.



Marvinol PVC blending resins are useful in a wide variety of applications.

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Plastisol systems are used in a wide variety of ways. Each blending resin has its areas of maximum suitability.

Marvinol 10 is one of the earliest known homopolymers as well as the highest molecular weight plastisol blending resin available to the plastisol industry. It is used in blends with dispersion grade resins such as Marvinol 51 at levels generally between 30 and 50%.

Fused films based on resin blends containing Marvinol 10 are characterized by very high physical strength, a dry, leather-like hand, and excellent hot tear strength.

Marvinol 10 also reduces viscosity, enhances air release and lowers gelation temperature. All these features combine to make Marvinol 10 virtually the sole blending resin used in the slush and rotationally molding fields for many years.

Marvinol 24PL is used principally in the popular

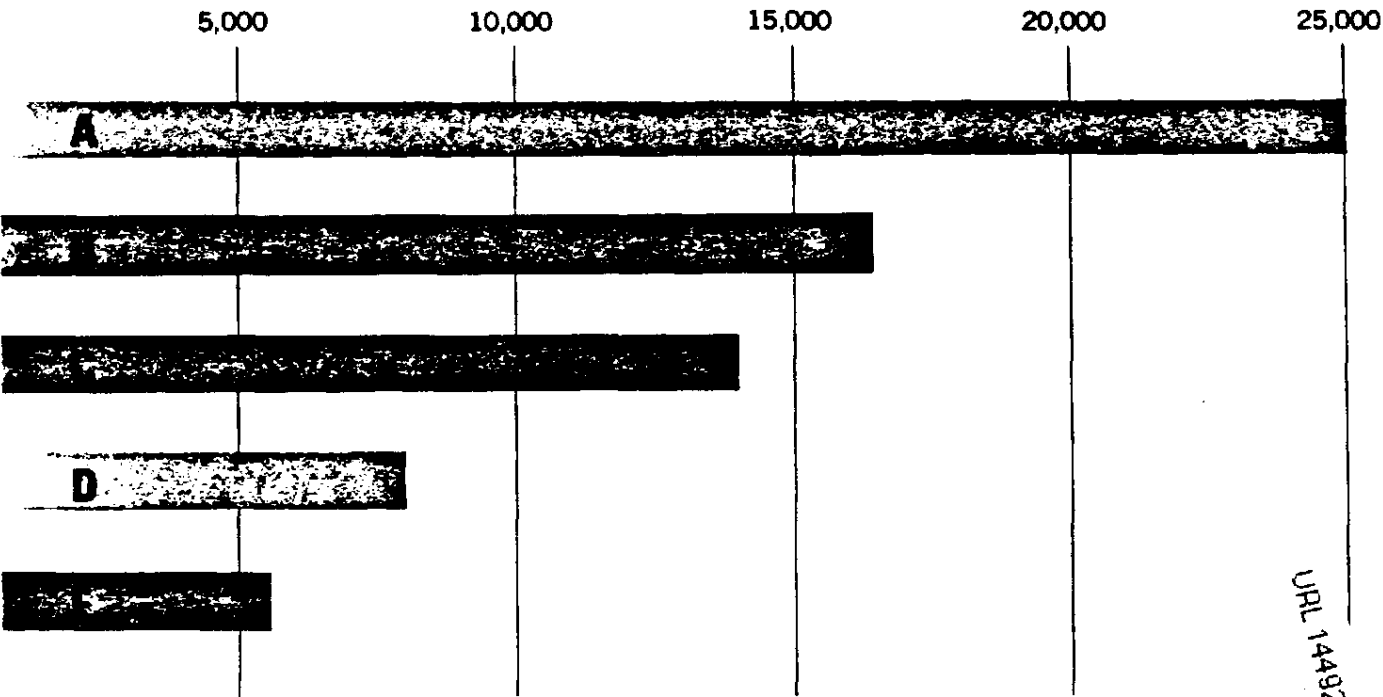
high temperature chemically blown foam type compounds. Its molecular weight is ideal for this. It is generally used in blends with Marvinol 53 and replaces as much as 50% of the dispersion resin without any loss in foam quality.

Marvinol 24PL has also proved its worth in applications where major properties sought are viscosity reduction, improved air release and an increase in gelation temperature by comparison with those properties available from the dispersion resin alone.

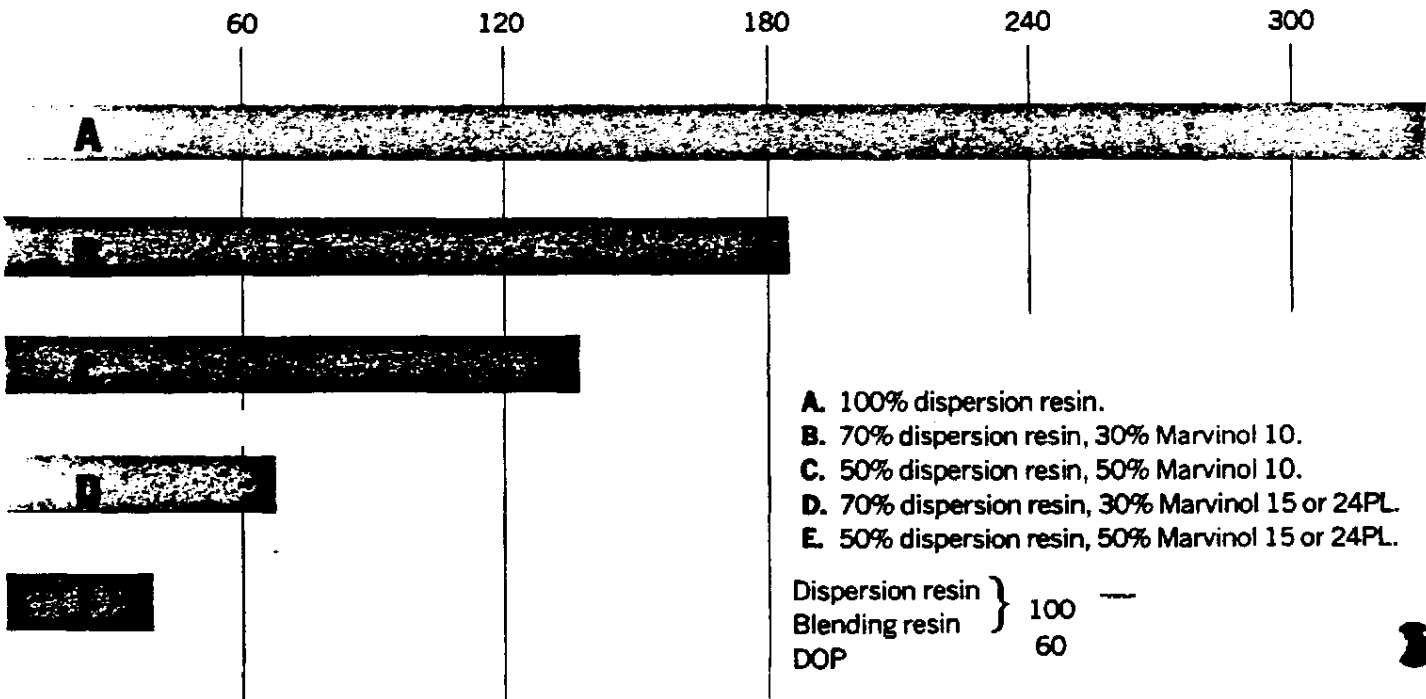
Marvinol 15 blended with dispersion resins such as Marvinol 50 is used in cloth coating work where the controlled particle size of Marvinol 15 enables compounds to be satisfactorily paint milled and spread coated, especially in lighter gage coatings.

Marvinol 15 is also used for gloss control. Again its controlled particle size allows for the development of non-grainy dull finish coatings for paper and cloth.

Brookfield viscosity in centipoises (Sp. #5,5 rpm).



Severs viscosity in poises (100 psi).



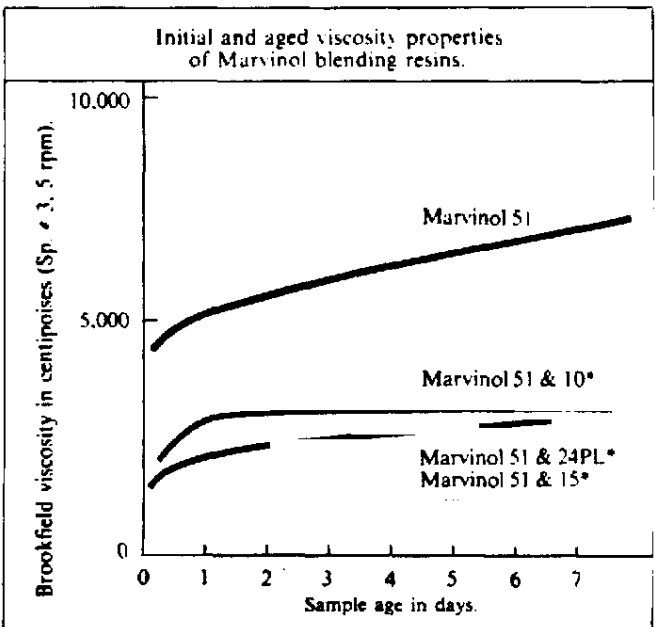
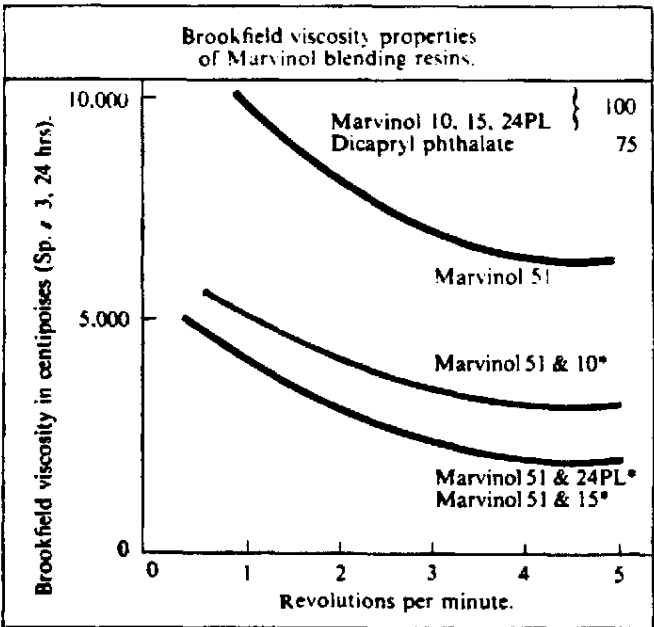
Marvinol blending resins reduce high and low shear viscosities.

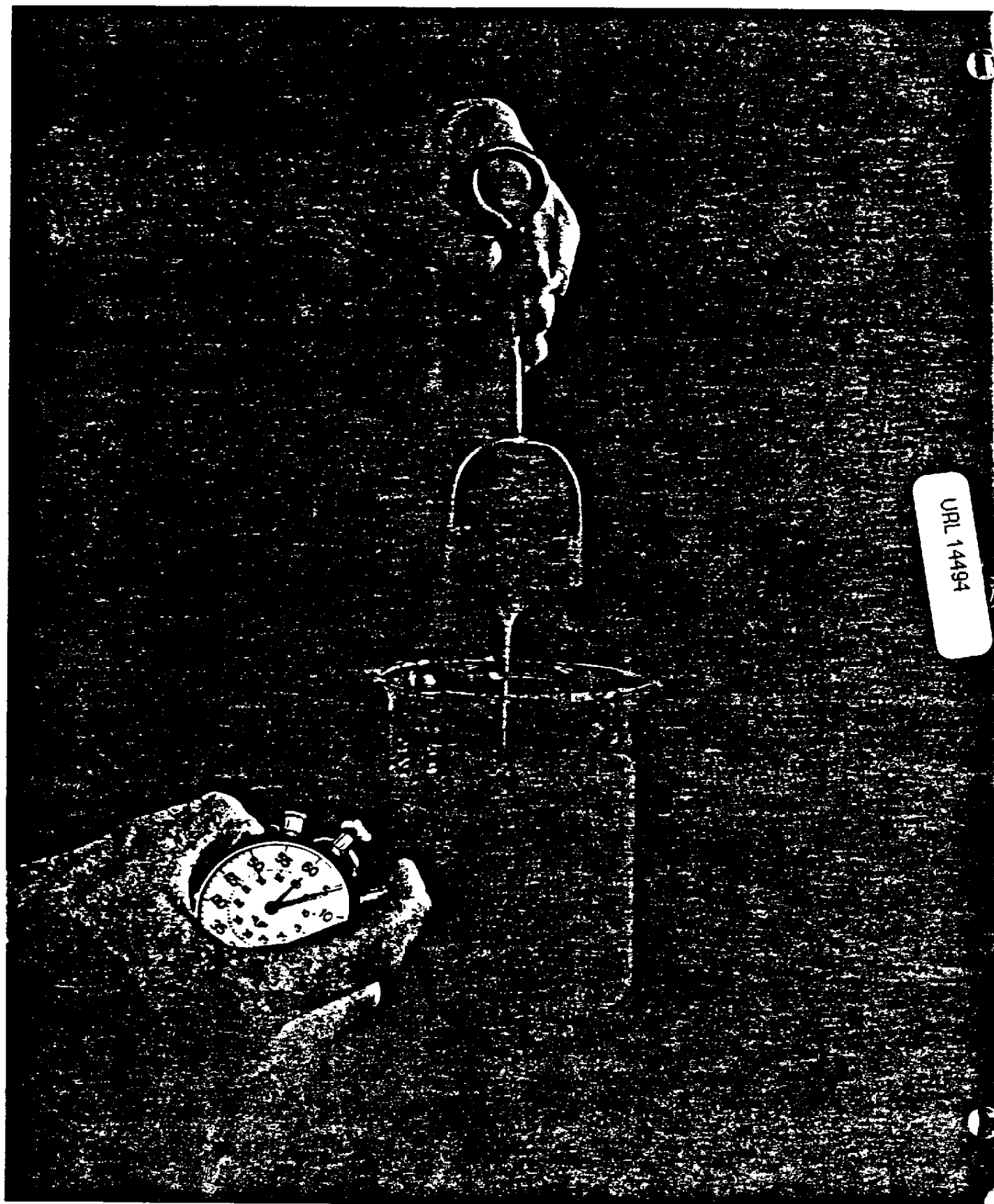
A simple dispersion resin recipe with 60 phr DOP is customarily used to describe the rheological properties of a plastisol resin. This recipe is also useful in measuring the effect of blending resins on the rheology of a plastisol.

The graphs at left and below show Marvinol blending resins imparting notable reductions in the low and high shear viscosity properties of plastisol compounds as measured with Brookfield and Severs viscometers. This reduction in viscosity is an essential requirement for many plastisol processes. This is par-

ticularly true in slush and rotational casting and rigid plastisol molding work.

The graph on left below shows the marked reduction in low shear viscosity associated with the use of Marvinol blending resins over a wide range of low shear rates. This reduced viscosity at low shear is essential for the compound to have sufficient fluidity to reproduce fine detail of a mold in slush and rotational casting. Graph on right below illustrates the initial and aged viscosity properties of compounds containing Marvinol blending resins.





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Marvinol blending resins enhance the air release properties of a plastisol.

The ability of a plastisol to spontaneously release entrained air is of paramount importance in all applications and particularly so in slush and rotational molding.

Marvinol blending resins enhance the ability of a compound to release entrained air rapidly. Some typical data shown in the following table illustrate this.

Resins	Huff air release time (seconds)
Marvinol 51	14
Marvinol 51/Marvinol 10*	10
Marvinol 51/Marvinol 15*	9
Marvinol 51/Marvinol 24PL*	6

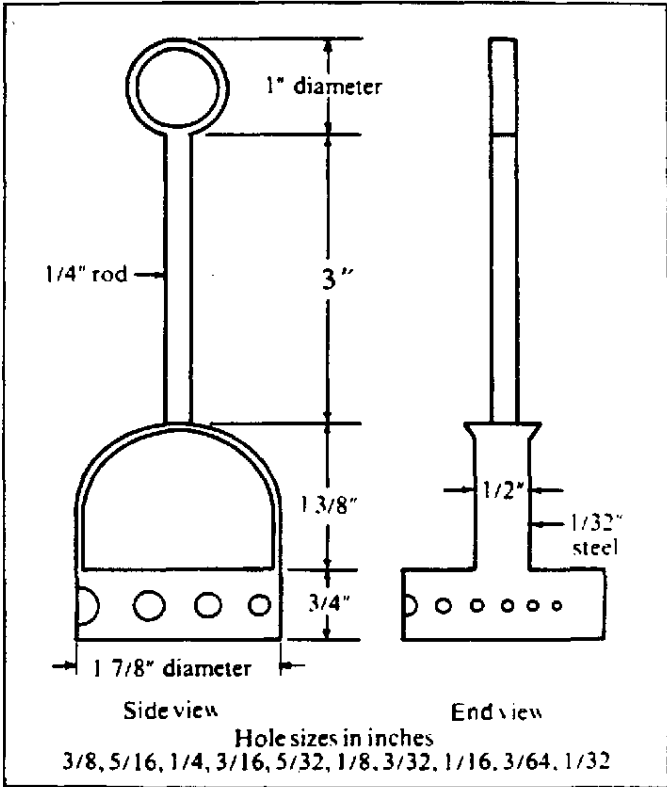
* a 70:30 blend.

The Huff air release tester used above is a convenient apparatus by which the air release properties of a plastisol may be measured. A Huff air release tester is shown in the photo at left. This apparatus measures the time required to break a plastisol film formed over holes of various sizes drilled into a metal cylinder. Wet film strength, dynamic surface tension and plastisol viscosity are some of the theoretical factors involved in air release.

Operation of the Huff tester is quite simple. The instrument is immersed in the plastisol, rotated several times and then withdrawn. The time in seconds

is measured from the instant the tester leaves the plastisol until the film breaks over a previously designated hole. Film rupture time correlates with a plastisol's ability to spontaneously release air bubbles.

Specifications for the Huff tester are given below.



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Marvinol blending resins can raise or lower a plastisol's gelation temperature.

As a plastisol is heated its viscosity decreases at first, reflecting the reduction in plasticizer viscosity with the increase in temperature. This viscosity drop is short-lived however, as the solvating effects of the plasticizer on the resin begins to manifest itself, i.e., the viscosity rises rapidly and continues until a gelled state is reached. This series of events is a function of both time and temperature. Plastisol gelation is utilized in the development of wall thickness in the molding of vinyl boots where the plastisol is first subjected to a slushing stage in a heated mold. In the hot dipping of glass aerosol bottles or plating racks, the item to be coated is preheated and dipped into the plastisol to develop a sufficiently heavy coating. This coating is retained when the bottle or rack is withdrawn. The ungelled plastisol drains from the object and the gelled material is then fused.

There are several techniques by which the gelation properties of a plastisol are characterized. One of these utilizes a Gel Plate technique as shown in photo at left. Here a film of plastisol is cast on a heated aluminum panel. After a period of one minute, a paper strip is lightly pressed onto the plastisol and stripped off. Where the plastisol has gelled, the paper does not adhere to the plastisol and strips clean.

Where the plastisol is still in a liquid or tacky state, the plastisol sticks to the paper. When the paper is pulled away, the transition between the gelled and ungelled state is well-defined on the plastisol. A surface pyrometer measures the plate temperature at this point and this measurement is taken as the gelation temperature.

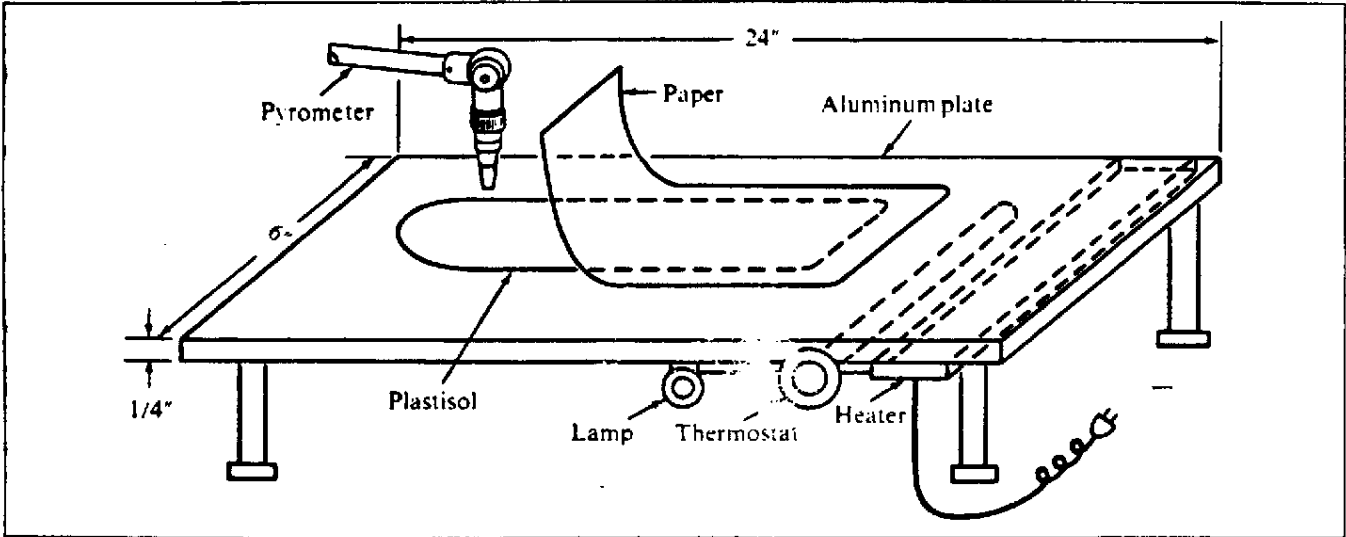
Specifications for fabricating a gel plate are shown below.

Marvinol blending resins alter the gelation properties of a plastisol.

Data below shows the effect of Marvinol 10 in reducing gelation temperature. In contrast Marvinol 15 and 24PL raise the gelation temperature of the unmodified compound.

Marvinol 51	DOP @ 60 phr	165° F
Marvinol 51/10 (70:30)	DOP @ 60 phr	155° F
Marvinol 51/15 or 24PL (70:30)	DOP @ 60 phr	180° F

Since the higher molecular weight Marvinol 10 produces a lower gelation temperature than the lower molecular weight Marvinol 15 or 24PL it is obvious that there is no direct relationship between molecular weight and gelation. The fusion temperature of a homopolymer system is not altered by the use of blending resins.



Major application properties of Marvinol 10, Marvinol 24PL, Marvinol 15.

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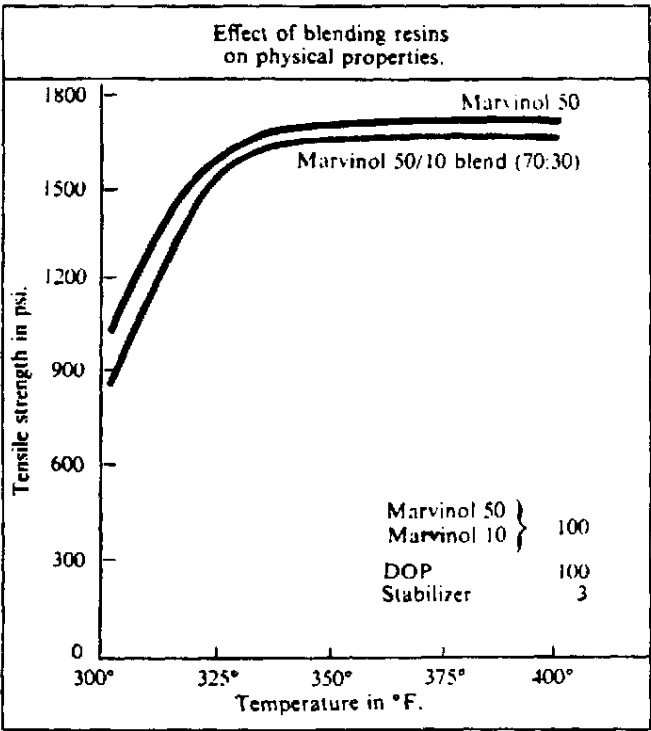
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Marvinol 10.

The physical strength of a fused plastisol is related to the molecular weight of the dispersion resin and blending resin used. Marvinol 10 is the highest molecular weight blending resin available. Also, its molecular weight is equivalent to and even slightly higher than virtually all dispersion resins now available. Thus, by contrast with other blending resins, there is no loss in the physical strength of a fused film containing Marvinol 10 used in any proportion with dispersion resin. The graph at right illustrates the tensile strength development of an all dispersion resin system and a blend containing 30% Marvinol 10.

The use of Marvinol 10 also produces a "dryness of hand," or slip property useful in footwear produced by slush casting.

Here the coarser solvated resin particles can be shown to form a microscopically irregular air surface on the plastisol casting thus providing a non-tacky surface.



Marvinol 24PL.

A dispersion grade resin designed specifically for chemically blown foam, i.e. using Celogen[®] AZ or Celogen OT, is Marvinol 53.

Its major success in this area results from its controlled molecular weight designed to optimize foam quality and physical strength. Marvinol 24PL is a blending resin designed to work with Marvinol 53 in foam. It is used in blends with Marvinol 53 up to a 50% replacement.

Low temperature foam compounds based on Marvinol 51 and Nitrosan (DuPont) also use Marvinol 24PL to advantage. Here gelation temperature of the compound is critical. It must be higher than the decomposition temperature of the blowing agent to enable the compound to completely expand before gelation occurs.

Marvinol 24PL with its property of increasing the gelation temperature of a plastisol is well suited for this type of foam also.

© UNIROYAL registered trademark for its blowing agent.

Marvinol 15.

In spread coating work the ability of a blending resin to lower compound cost is its primary function. To do so however, a blending resin must possess a particle size such that the compound will properly coat under a knife or through a roll coater without coarse particles becoming lodged and damaging the coating. Marvinol 15 provides such a resin.

Where a dull finish is desired, e.g. coated paper or flooring, Marvinol 15 with its controlled particle size provides a dull, uniform sheen, free of coarse particles. Degree of gloss reduction may be controlled by the relative amount of Marvinol 15 used plus fusion heat, i.e. higher fusion temperatures, tend to flux-in the blending resin and thus increase gloss.

Where it is customary to process a plastisol through a three roll paint mill as part of the compounding procedure Marvinol 15 processes through the mill without particle hang-up in the nip of the rolls as is the case with coarser blending resins.

There are eight Marvinol plastisol resins for use with Marvinol 10,15 and 24 PL.

In addition to Marvinol blending resins, **UNI-ROYAL CHEMICAL** can supply any of the following dispersion grade resins, with more to come in the future. All meet the sophisticated requirements of the vinyl industry.

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Marvinol 50	An all-purpose PVC plastisol and organosol dispersion resin. Readily stirred into plasticizers to form plastisols with low Brookfield and Severs viscosity properties. Excellent for cloth coating and flooring where high physical strength and high gloss are desired.
Marvinol 51	Readily stirred into plasticizers to form plastisols with low Brookfield viscosity and outstanding air release properties. Excellent for slush molding, rotational casting, chemically blown plastisol foam.
Marvinol 53	Readily stirred into plasticizers to form plastisols of outstanding quality with respect to chemically blown foam. Also well-suited to processing conditions requiring reduced gelation time, low viscosity and excellent air release, e.g. slush molding, rotational casting, hot and cold dipping, etc.
Marvinol 55(X 6116)	A stir-in copolymer dispersion resin designed for lower fusion temperature applications. High viscosity and rapid gelation features control cloth penetration.
Marvinol 56	A stir-in copolymer plastisol resin combining low Brookfield and Severs viscosity properties with rapid gelation and low fusion temperature properties. Ideally suited for a wide variety of plastisol casting, molding, and adhesive applications, where a combination of low temperature fusion and low application viscosity is required for more rapid processing or in the coating of heat sensitive substrates.
Marvinol 57	A stir-in copolymer dispersion with uniquely low-viscosity properties combined with low-fusion temperatures.
Marvinol X 6085	A stir-in homopolymer with uniquely low viscosity properties. Also provides excellent gloss control.
Marvinol X 6215S	A plastisol resin that's well-adapted to high plasticizer level compounds where high viscosity and yield are required to develop strike-through resistance. Excellent for chemically blown foam.

Starting point formulations based on Marvinol dispersion and blending resins.

These formulations are based on Marvinol dispersion and Marvinol blending resins. In each case, the selection of blending resin is based on the Marvinol resin best equipped to handle the specific application.

Applications →	Slush and rotational molding	Low gloss paper & cloth coating	Foam (high temperature)	Foam (low temperature)	Foam (pressure molded)	Semi-rigid molding	Hot dipping
Marvinol 50		70			60		
Marvinol 51	60			70			
Marvinol 53			60				60
Marvinol X 6085						70	
Marvinol 10	40				40		40
Marvinol 15		30					
Marvinol 24PL			40	30		30	
DOP	30	55	95	95	65		55
DCP	35					30	
Epoxy plasticizer	5	5	5	5	5	5	5
Extender plasticizer						5	
Ba, Cd, Zn stabilizer	3	3		3		3	3
Stabilizer - foam activator			3				
Dythal					3		
Naphtha						4	
Celogen AZ			2		20		
Nitrosan				4			

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