

UVACURE HS 23 SERIES INKS

TECHNICAL MANUAL

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image inks

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UVACURE HS 23 SERIES INKS

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INTRODUCTION

The dry offset process provides the most satisfactory method for the high speed, large volume printing of multi-coloured line copy, halftones and full process art on preformed containers. Dry offset is used primarily to print products such as tapered cups, tubs and buckets as well as tubes, jars, cans (aerosol and beverage), bottles and their respective closures (lids, can ends, caps).

Dry offset printing is similar to offset lithography in that a rubber blanket is used to carry the image from the printing plate to the container surface. The plate used has, as in letterpress, the image area raised above the surface of the plate. Ink is distributed through a series of rollers and onto the raised surface of the plate. The plate transfers the image to the blanket, which then prints the entire multicolour copy taken from one to as many as eight plate cylinders and transferred on the container in one operation. The "dry" denotation of this offset system serves to differentiate it from the offset system which uses the incompatibility of water and inks to "dampen" the surface of the plate or substrate to prevent ink transfer.

One to ten colours can be printed in a single pass over the container, with all colours being applied simultaneously by the same blanket. The inking station on each colour head contains the ink fountain and the individual set of rollers. The number of rollers and their arrangement guarantees the finest most uniform distribution of ink to the individual plate cylinder. The ability to effectively distribute the ink as an even film across the full width of the design is the object of the system.

The offset blanket is inked in turn by each plate cylinder, each plate cylinder having all of the copy for one colour. The printing plate is prepared by a photochemical process, providing extremely fine reproduction of delicate artwork. The plate cylinder holds the printing plate, which is secured to the cylinder by clamps or through magnetism. Each plate cylinder has a very fine micrometer (.001 of an inch in any direction) adjustment. The inked printing plates deposit their image in sequence and in registration on a common printing blanket. The paste-type ink used in this process, whether ultraviolet or conventional in nature, allows wide latitude in choice of colours that are resistant to scuffing and moisture.

The blanket platen holds the rubber printing blanket, which is secured through the use of either "sticky back" material or ratchet clamps. The size of the blankets match the circumference of the container in length and is cut marginally wider than the height of the printed design. The blanket transfers all of the images and copy to the container in one pass. Various blanket materials and blankets with different thickness are available for varying printing requirements on different containers.

The container shape and its tolerance are important, not only for the mechanical nature of its handling, but also for the quality of print that can be transferred to it.

The material handling section of the decorating line is customized for the individual

style container. The indexing or constant motion turret holds the specific container tooling, commonly called mandrels (or spindles), during all operations including printing. The material handling section or the individual container tool can be swivelled for container taper and positioned for printing pressure. Because of the pressure required for printing, containers must be supported by a mandrel or inflated with air pressure. Surface blemishes, uneven mold join lines and uneven container wall thickness should be avoided.

When required, containers can be cleaned by rotating them in front of a de-staticizer which uses ionized air to remove static and dirt particles. The plastic surface is prepared to promote the adhesion of ink to the substrate with either a flame or corona system.

The characteristics of the plastic substrate must always be considered as part of the printing operation because the nature of its surface is significant in determining suitable ink formulations for printing on it. Dry offset inks are available for printing all the common packaging plastics. Polyolefin surfaces are both inert and have a low surface energy with the result that inks printed on them tend to reticulate and possess poor adhesion. The problem is overcome by modifying the surface using either a corona discharge or flame treatment. However, it is essential to control this treating operation if optimum print performance is to be achieved. Corona discharge is a popular method for treating plastic films but is losing ground to flame treating for containers. Other substrates such as the vinyls and styrene are much less inert than polyolefins and pretreatment is unnecessary.

Stations for orientation can be provided which use a container lug, side seam or bottom notch to register the container prior to the print station. After printing, the parts pass through the print curing unit (for "on mandrel" drying) or are transferred to a conveyor for transport through an appropriate dryer oven (ultraviolet or infrared).

Print production speeds are high: tapered plastic containers such as yogurt cups are handled by indexing equipment up to 500 parts per minute; constant motion two piece beverage decorating equipment operates at up to 2000 + cans per minute.

Auxiliary equipment for automatic operation such as feeds, take off devices and dryer ovens are all important adjuncts to an offset printing system for containers. No system is universal, and while most are designed for size changeover among product lines or families of containers, few will permit the modification required to handle various types of containers (such as jars, tubes and bottles).

Dry offset is used to decorate more preformed containers than any other process because it is a high volume, low cost per container process. A printing line is designed to handle a range of sizes of the same type or family of containers, such as cups, tubes, jars or cans and their respective closures.

Dry offset handles rounds, tapered rounds and flats best; with appropriate tooling, irregular shapes such as squares and rectangles can be handled at slower speeds. Ink lay down is minimal, so that opacity is best on a white container; light colour printing on a dark substrate is not recommended.

CHARACTERISTICS

UVACURE Inks are special inks for the dry offset (letterset) printing field based on Ultra Violet reactive acrylic resins. Their primary use is in the printing of plastic containers such as cups, buckets and lids for various products such as yogurt, fats, detergent, paint, etc.

UVACURE Inks are the product of many years of experience and research in printing inks, using the latest raw material developments and manufacturing techniques.

UVACURE Inks are specially formulated so that under normal circumstances they may be used directly from the container. Because of the extreme reactivity of the system, Ultra Violet inks and varnishes have a limited shelf life. We guarantee a shelf life of 6 months under proper storage conditions, i.e., under 70°F (20°C) and protected from direct sun light. Specialty inks including fluorescent and metallic colours (once mixed) are more unstable and should be used as soon as possible and therefore are not guaranteed.

RESISTANCE PROPERTIES

UVACURE Inks show exceptional resistance and adhesion properties to all the usual products such as fat, oil, yogurt, ice-cream, desserts and other dairy products. If there is any question about the resistance to a particular filling, we recommend testing prior to use. We are equipped to perform these tests at our laboratories.

UVACURE Inks fulfill the Food, Health and Safety requirements of most countries, as well as California Proposition 65. Their optimum adhesion properties make them ideally suited for the printing of food packages and similar containers.

SUBSTRATES

UVACURE Inks are ideally suited for the printing of containers that are most commonly used in the food packaging industry. For example, polyvinylchloride (PVC), polystyrene (PS), acrylnitrilbutadienestyrene (ABS), polyethylene (PE) and polypropylene (PP). To achieve trouble free adhesion on PE, PS, and PP, pre-treatment of the substrate is recommended. The most commonly used methods of pre-treatment are Corona discharge and gas flame.

In general, when producing small containers (yogurt and margarine cups), pre-treating with Corona discharge is preferred, whereas with larger containers (buckets), gas flame pretreatment is more suitable. On PE and PP it is recommended to achieve a surface tension (pre-treatment intensity) of at least 40 mN per metre (40 dynes/cm), this guarantees maximum adhesion properties. Surface tension tests can be performed at press side with a dyne tension test kit, a relatively inexpensive item. Contact us if you need more information on treatment systems or test kits.

MACHINE CONDITIONS

For UV printing, we recommend rollers and blankets which are ester and ketone resistant. Most well known manufacturers have suitable grades, and they should be consulted. Natural rubber qualities are rarely attacked by the UV inks, but they can be damaged by UV washes. UV rollers and blankets can also be sensitive to mineral oils and petroleum distillates. Although metal plates, for example zinc or magnesium, can be used, nyloprint (Photopolymer) plates have been found most suitable. In case of doubt about roller and blanket suitability, we recommend a small, easy test which will be discussed later under the heading "Printing Technical Advice."

DRYING / CURING

UVACURE Inks dry chemically by polymerization. The energy necessary for "curing" the ink is provided by UV lights with a maximum emission in the region of 260 and 360 nm. The absorption range of UVACURE Inks have been designed to make optimum use of the emission ranges as mentioned above.

Unlike conventional inks, the use of catalyst dryers to influence drying speed is not possible with UVACURE Inks. UVACURE Inks, and UV varnishes must NOT be mixed with conventional inks, varnishes or additives, or other UV type products.

UVACURE INK SERIES

1. HS 23 Standard Inks

The Type HS 23 Series Inks are a PANTONE® based system primarily used for cups, buckets, lids and tubes. This series is specially formulated to offer premium resistance properties as noted in this manual. It is particularly suited to containers that require exceptional filling, dishwasher and weathering resistance properties.

2. UVACURE Metallic Inks

873 Gold Varnish UV 23871
872 Gold Varnish UV 23872
873 Gold Varnish UV 23873
874 Gold Varnish UV 23874
875 Gold Varnish UV 23875
876 Gold Varnish UV 23876

Gold Paste U 0070

877 Silver (1-part) UV 23877

Mixing - The gold inks are based on a two part system which includes a paste component and a varnish component which will yield the desired Pantone® colour. Each

component constitutes one half of the finished ink. For example, if an 873 gold is required, 50% of UV 23873 is mixed with 50% of U 0070 (1:1 ratio) to achieve the desired results. Each colour is mixed to this ratio. Shelf life of the mixture is of very short duration; only the amount needed for a particular print job should be mixed at any one time.

In view of the physical nature of metallic pigments, the rub resistance properties of UVACURE Metallic Inks are slightly inferior to those of other UVACURE Inks. In some cases this can lead to rub marks on the inner side of cups during nesting.

3. UVACURE Additives

U 0025 - Photo Initiator: An extremely effective additive for increasing cure speed. An addition of 1 - 2% is sufficient to dramatically improve cure response.

U 0035 - Slip Additive: Maximum amount of addition should be 3%. Adding this item will improve the scratch resistance.

U 0045 - Reducer: This product should be incorporated at levels of 1 - 4%. This will reduce the tack and viscosity of the inks.

U 0055 - Anti-Mist Gel: A gel for reducing misting at high speeds. A maximum addition of 10% should eliminate most misting problems.

4. UVACURE HS 23 Light Fastness Ratings*

Colour

Yellow	5-6
Warm Red	5-6
Rubine Red	5-6
Rhodamine Red	2-3
Purple	3-4
Violet	1-2
Reflex Blue	1-2
Process Blue	7-8
Green	7-8
Mix Black	5-6
Dense Black	5-6
021 Orange	5-6
032 Red	5-6
072 Blue	7-8
Process Yellow	5-6
Process Magenta	3-4
Process Cyan	7-8

* Blue Wool Scale (8) Excellent (1) Poor

PRINT TECHNICAL ADVICE

UVACURE Inks are delivered print-ready and require no additives or modification. If problems do arise, they can usually be resolved easily and conveniently. We are taking the liberty of offering a few hints and some advice in the following pages. In particular, we draw attention to the demanding wet-on-wet printing and the problems associated with the printing of transparent or coloured substances. In addition, we draw attention to the difficulties associated with printing bar codes.

DUCT PERFORMANCE

Colour matches are normally formulated to high pigment strengths as the trend to increase print quality inevitably leads to lower film weights. When formulating special colour requests using inks containing pigments with adverse flow characteristics, which is sometimes unavoidable, the flow of printing ink in the process may not always perform up to the expected standard. In these cases the addition of UVACURE Reducer U 0045 in quantities of 1 - 4 % can quickly resolve this problem. We consider it more sensible and technically advanced to formulate all inks to high pigmentations which can be adjusted as necessary.

MISTING

In general, misting is a rare event. Because of their lower viscosity, light colours can show a slight tendency to mist. This annoying appearance is not only the result of thin consistency, but is very often influenced by extreme temperatures in the press and in the relevant duct. At high printing speeds and high consequent revolutions per minute of the rollers, decreased viscosity of the ink no longer stands up to the shear forces created. This may cause a misting effect. The misting effect may be eased through the addition of Anti Mist Gel in quantities of 2 - 5 %.

ESTER RESISTANCE OF RUBBER MATERIALS AND PLATES

The following hints and advice are primarily for customers using UVACURE for the first time. As mentioned previously, UVACURE Inks demand a suitable quality of roller, blanket and plate. Additionally, unsuitable blankets may be attacked by UVACURE Inks leading to an unacceptable degree of swelling that adversely affects print quality.

We recommend a quick and easy test to proof the quality and suitability of printing blankets and rollers. Apply one drop of UV Reducer to the clean rubber rollers and the printing blanket. If the UV Reducer is absorbed within half an hour or if there is any sign of swelling, the rubber roller or printing blanket will not be suitable for printing with UVACURE Ink.

Certain photopolymer plates may also be unsuitable for UVACURE Inks. Testing prior to use, as mentioned above, should be carried out. In this case, special attention should be paid to the stickiness and/or dissolving of the plate material during to the test.

DRYING PROBLEMS

Increased drying speed can only be achieved through increased UV light intensity, whereby the thermal capacity of the printed substrate is the limiting factor, or by adding 1 to 2 % of photo initiator U 0025. Normally, the addition of photo initiators is not necessary because UVACURE Inks are formulated for high printing speeds. The efficiency of the U.V. dryer has to be adapted to each system according to its requirements. The distance from the lamps to the printed surface (focal length) should be perfectly adjusted. As a matter of principle, the U.V. lamps **MUST** possess the necessary efficiency. Please take careful notice of the lamp life. Reflectors and lamps **MUST** be clean and therefore have to be regularly serviced. Please observe the manufacturers instructions.

When using UVACURE Inks we recommend a cooling apparatus at the end of the conveyor, so that the cups may be nested at the lowest possible temperature. This will prevent the cups from sticking together and pulling the ink off the cup. UVACURE inks are thermo-plastic (i.e. at higher temperatures, a certain smear may occur which can occasionally be seen at the cup edges). This is caused by nesting cups at excessive temperatures.

Ink related drying problems are normally the result of high film weights. As a consequence, a rub-off of ink in the inside of the cup may be noticed. The reason for high film weights is very often found in the wrong choice of colour or, from an intensity point of view, in the wrong selection of inks. We would gladly supply a higher pigmented ink should colour intensive standards be difficult to reproduce using standard inks. In principle, these higher pigmented inks at normal film weights demand a higher drying time.

INK ADHESION

Inadequate rub resistance properties as well as lower scotch tape resistance properties on PP/PE, (not withstanding product drying procedures), are very often the result of insufficient or inadequate pre-treatment. It may also be caused by surface oriented additives. In the latter case, an addition of UV Slip Additive U 0035 in quantities of 1 - 2 % is recommended. If this does not clear up the problem, a different substrate should be used. An alternative solution, as far as inks are concerned, is not possible.

Another difficulty is created by the inclusion of anti-static additives in many plastics. These will migrate to the surface and interfere with the plastic's ability to accept the ink. Additionally, these anti-static additives are mainly hydrophilic (absorb water), and can decrease the moisture resistance of the film.

WET-ON-WET PRINT / HALF-TONE WORK

For multi-colour printing we recommend the sequence: Yellow-Red-Blue-Black. Normally the tack of the first 2 inks applied should be higher than the tack of the third and fourth inks. If the first 2 are not tacky enough they will be lifted from the cup when the other inks are laid down.

FILM WEIGHT

Normally in the dry offset field, the amount of ink distributed onto the rollers is referred to as lay down or film weight. An offset press requires 1 to 1.5 grams per square metre of film weight. High film weights can lead to ink build up on the plates and blankets as well as reduced scratch resistance, adhesion problems and overall curing difficulties. To improve print quality and in order to avoid smudged edges, the film weight must be reduced. Particularly in half-tone work, a film weight in the region of 1 gram per square metre or less is necessary to achieve optimal print quality.

For single colours as well as the most complicated multi-colour wet-on-wet print, it is important to adjust printing pressures and ink ducts to achieve optimal results. Since plastics lack the absorption qualities of paper, (on which high print pressure during the ink transfer can be compensated through the setting effect) increased print pressure on plastics will inevitably result in a push-out of the ink from the original print and distort the image. Even the most skilled printers, reproduction institutions and plate manufacturers must take this unavoidable fact into consideration.

PROCESS PRINTING

In 4 colour process work, there are two process sets available as follows:

A - When using PANTONE basic colours for process printing, the following UVACURE inks are recommended:

Yellow	UV 23080	Rubine Red	UV 23084
Process Blue	UV 23088	Dense Black	UV 23299

B - When cleaner process colours are required, the following Step-Tack UVACURE inks are recommended:

Process Yellow	UV 23040	Process Magenta	UV 23043
Process Cyan	UV 23045	Process Black	UV 23047

In view of unavoidable technical printing difficulties, we do not recommend coloured reproductions using the 4 colour process principle in the cup and lid printing field. The current technique, which deposits a single colour next to and on top of each other on a single printing blanket and subsequently transfers the combined image to a cup or lid is totally different from the commonly used technology in the offset field. It is therefore highly recommended to select different colours for the multicolored print, then approach the build-up of the image from a different angle.

In this process the maximum screen value is 54 lines per cm. This degree of difficulty, however, should only be attempted after prolonged technical experience in the printing of half tones. Larger screens (30/40 lines per cm) are ideal to begin with.

It is also advisable to deposit the lightest colour on the blanket first, followed by a darker colour and finishing with the darkest colour.

For example, a combination of yellow, red and black should be deposited as follows:

First Colour	Yellow
Second Colour	Red
Third Colour	Black

Note that by printing wet-on-wet the curing speed of the UV inks decreases. By using the recommended colour order the unavoidable contamination caused by back-trapping will thus be minimized.

BACK-TRAPPING

Back-trapping is actually the event of one ink being transferred onto the plate of another colour then back-trapped to the rollers. This contaminates the ink in the ducts and affects the overall colour that is trying to be achieved.

If the second or third colour does not trap on the ink already deposited on the printing blanket, a small correction is required. By using UV Reducer, the tack of the subsequent darker colour is reduced and it will trap satisfactorily on the ink film already deposited. Such additions should be made very carefully at a rate of 1 - 4%, which in most cases will prove more than adequate.

UVACURE Inks have been formulated to a narrow, limited tack range which aids in 2 colour printing. Based on experience, the correction of tack is mostly required when adding a third colour.

Large wet-on-wet prints should be avoided. In this instance, the danger of colour contaminations are particularly acute and under some circumstances the tack may have to be adjusted on the two colours already printed.

When printing wet-on-wet half-tone colour, the dirtying of subsequent colours is negligible. The biggest single cause of contamination in the wet-on-wet printing field is excessive print pressure. Adjustments to ink should only be viewed as adding the finishing touches to achieve optimum results. In addition to the effects of excessive printing pressures, increased printing pressures will also adversely affect ink and colour intermixes.

For optimal adjustments in printing wet-on-wet, each layer should be adjusted individually and be printed with the least possible pressure. In this way, errors and incorrectly adjusted pressures may be easily detected. At the point of pressure, it is advisable to first print two colours and then the subsequent colours later. In this way it is easy to recognize which ink requires an adjustment of tack.

PRINTING OF TRANSPARENT AND COLOURED SUBSTRATES

For multi-coloured reproductions and wet-on-wet prints, white substrates are best suited. However, there has recently been a trend to use transparent substrates. This trend, however, which is of growing importance has created additional printing difficulties. On transparent substrates it is increasingly common to print UVACURE white as a contrast colour to dark filling contents (for example, chocolate dessert). It is therefore desirable to provide increasingly opaque and more highly pigmented whites. As mentioned previously, higher pigmentation inevitably leads to difficulties associated with transfers and adhesion. Highly pigmented inks have a reduced content of varnish, which is usually the carrier of the key adhesion capabilities.

Specific problems will arise when printing coloured inks on transparent cups which are intended to carrying goods of different colours. White fillings, such as yogurt and cheese, have little effect on the printed result.

UVACURE Inks, with the exception of white, are manufactured from organic pigments which have a high transparency. They are of prime importance in multi-colour and half-tone printing. Existing Food, Health and Safety regulations prevalent in the world, do not permit the use of certain inorganic pigments in inks intended for cups and lids intended for the food packaging industry. Certain inorganic pigments do, however, offer a greater degree of opacity. In view of this fact, transparent coloured ink can and must be adjusted with an adequate addition of white to insure a certain degree of opacity. However, by increasing the white content and therefore the opacity, the original colour shade is altered. Normally, if a large percentage of opaque white is added to a colour, the final printed colour will be a different shade than the originally approved colour. It is therefore necessary to accept certain tolerances and minimum opacity to ensure a given quality of print. Any additions should be started by adding 10 % (1 in 10), and should be increased gradually in stages of no more than 10 %.

The aforementioned also applies to coloured substrates, especially if the colour is very bright. Additionally, we would like to point out that if a certain colour has been achieved by silk screen, the results achievable by the offset printing technique will vary widely.

Finally, we would like to mention that metallic colours offer excellent opacity, and give good results when printing on a coloured substrate.

BAR CODING

It is known that photo-electric readability of line symbols depends largely on the contrasting effect of line symbols and the surrounding base colours in the measuring range of scanners (normally 633 +/- 20 um). This is easily done if the substrate or colour is white, yellow, orange or red and the line symbols are black, blue, very dirty green or brown (low emission colours).

In the cup printing field, however, we can experience difficulties. White coloured substances show a remission value of approximately 70 %. With thin wall containers this value can even be lower when the contents are dark. Such circumstances demand a very high print contrast of line symbols to surrounding area, so that the readability of the code is insured.

With coloured and transparent substrates a readable code is often no longer possible. Transparent cups, when filled with coloured goods which form a background colour, can exceed the necessary emission to apply a readable line symbol. In many cases the laser beam will be absorbed by the colour of the filling. In such cases using the code as a negative print will also be unsuccessful in view of the low emission capability of the most suitable ink in question (opaque white).

WASH-UPS

During wash-ups of the printing press, protective gloves are recommended as frequent contact with solvents can result in dry and de-greased skin. In extreme cases, dermatological problems may result.

Protective goggles and aprons are also recommended.

Always keep spare aprons and gloves at hand and replace worn or damaged items immediately. In case of eye contact, rinse eyes thoroughly for 15 minutes.

After prolonged skin contact with wash-up solutions, wash hands with a pH negative soap and warm water, do NOT use solvent. We also recommend applying a lanolin based moisturizing cream.

For press wash-up we recommend our **imagemaster** Solution. Residual wash-up left on the rollers and blankets can lead to printing problems, and can detrimentally affect the efficiency of the UV cure.

Alternatively, a mixture of ethyl acetate and isopropyl alcohol (isopropanol) in a 1:1 proportion may be used, but prolonged use of these solvents should be avoided. Please observe the manufacturers instructions. It has been popular to use alternative wash-up solutions, which in many cases have been blended with aromatics, aliphatics and chlorinated hydrocarbons, which have proven both active and economical. However, prolonged use of these solvents adversely affects both blankets and rollers and are therefore costly in terms of blanket and roller replacement and repair. If swelling occurs on the blankets, a "brittling" tendency may result.

The following solvents are damaging to butyl rubber and photopolymer plates:

hexane
petrol
cyclohexane

trichloroethylene
perchloroethylene
carbon tetrachloride

benzyl alcohol
dimethyl formamid
methyl ethyl ketone

benzene
toluene
xylene

isopropyl chloride
dichlorfluormethane
turpentine

methyl alcohol
methylene chloride
dipentene

Note: Chlorinated solvents are suspected cancer causing agents and have been banned from the workplace.

INSTRUCTIONS FOR HANDLING U.V. INKS AND VARNISHES

We quote extracts from the list of recommendations of the Professional Association - "Print and Paper Converting and the Association of the Printing Ink Industry":

- Observe the instructions on the pack or drum.
- Skin contact with U.V. curing inks, varnishes, additives and wash-ups has to be avoided. Above all, avoid rubbing any materials on the face.
- Wear safety gloves to protect against accidental splashing of inks, or solvents. Avoid the soiling of clothes with U.V. products, as skin can be contacted in this way. Skin contact can also be caused by handling uncured printed product, or from used cleaning rags.
- In case of accidental contact, clean affected skin only with mild hand washing gel, or soap and water. Do not wash with solvent.
- Immediately change working clothes soiled with ink or solvent.

When properly used and cured effectively, the dried film is chemically inert, so that it is stable, and cannot be affected by external influences. It is possible to detect a residual odour from the UV curing point, which amongst other things can come from ozone or substrate. This odour will dissipate after aeration.

PLEASE NOTE

The information and recommendations contained herein are offered as a service to our customers, but are not intended to relieve the user from his responsibility to investigate and understand other pertinent sources of information and to comply with all laws and procedures applicable to the safe handling and use of these materials. The information and recommendations provided herein were believed by the Image Group to be accurate at the time of preparation or obtained from sources believed to be generally reliable. However, the Image Group makes no warranty concerning their accuracy and the image group will not be liable for claims relating to any party's use of or reliance on information or recommendations contained herein, regardless of whether it is claimed that the information or recommendations are inaccurate, incomplete or otherwise misleading.

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