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TEXTILE CHEMICAL MANUFACTURING

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- ISO 17025 : 2017 (NABL Certified Laboratory)
- ISO 45001 : 2018
- ISO 14001 : 2015
- ISO 9001 : 2015



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SARAFLAM-THPC

Durable Flame Retardant For Cellulosic's



Flame retardant finishes are chemical treatments applied to textiles to increase their resistance to ignition, limit oxygen supply, and slow the spread of flames. These finishes utilize phosphorous, nitrogen or halogen compounds to create a protective thermal barrier. These finishes create a physical barrier or release compounds that choke the oxygen supply and cool the fabric, giving precious time to escape or extinguish the flames. Common chemical technologies available for Flame retardants are as follows:

- ▶ **Phosphorus and Nitrogen (THPC/U):** Used heavily in cellulosic fibres (like cotton). These trigger a chemical reaction causing the fabric to char rather than burn.
- ▶ **Halogenated Compounds:** Release non-combustible gases that dilute oxygen at the flame front; largely being phased out due to environmental and health concerns.
- ▶ **Intumescent Coatings:** Swell up when exposed to intense heat to form a thick, heat-insulating foam or carbonized char barrier.

Sarex has recently launched a THPC-U based flame retardant, Saraflam-THPC and this article will focus on the application of THPC-U based flame retardant on textiles. THPC-U (Tetrakis Hydroxymethyl Phosphonium Chloride - Urea) is a specialized, highly durable flame-retardant finish primarily used for cotton and cellulosic fibres. It refers to a pre-condensate of Tetrakis (hydroxymethyl) phosphonium chloride (THPC) and

urea. This complex ensures long-lasting fire resistance for protective workwear and upholstery, even after repeated washings. During the fabric finishing process, often called the Proban process, the chemical reacts to form an insoluble, high-molecular-weight polymer within the fibres. Treated fabrics retain their fire-retardant capabilities even after repeated washing.

Mechanism of Saraflam-THPC

It relies on a synergistic phosphorus-nitrogen mechanism. The presence of urea adds nitrogen to the phosphorus from the THPC, creating a synergistic effect that significantly boosts the flame-retardant properties of the cotton. When exposed to heat/fire, the phosphorus and nitrogen interact with the cellulose in cotton, promoting char formation and inhibiting the combustible gases that feed a fire. Phosphorus promotes char formation, while nitrogen acts as a synergist, allowing the polymer to form a protective, intumescent barrier that starves the fire of oxygen and fuel.

The THPC-urea finish is renowned in the industry as the basis for the Proban process. The Proban process changes how cotton behaves when exposed to high heat. Upon contact with a flame, the chemicals break down and force the cotton fibres to carbonize (burn into charcoal) rather than feeding the fire. This carbonization creates an insulating layer of char that blocks oxygen and protects the wearer from the heat source. Unlike synthetic fabrics (such as polyester), THPC-U treated fabrics will not melt, drip, or stick to the skin.

Proban is a globally licensed chemical treatment that makes cotton and cellulosic fabrics flame-retardant. Developed in the 1950s, the process uses specialized polymers embedded within the fibres to force the material to self-extinguish as soon as a flame source is removed, preventing the spread of fire.

THPC-U treatments are standard in environments where stringent fire safety is mandatory. Common applications include:

- ▶ **Industrial Workwear:** Protective apparel for oil, gas, and electrical sectors.
- ▶ **Military & Uniforms:** Flame-resistant tactical gear.
- ▶ **Home Furnishings:** Curtains, mattresses, and upholstery where fire codes apply.
- ▶ **Children's Sleepwear:** Compliance with flammability regulations.

▶ **UNIQUE FEATURES**

- ▶ **Durability:** Saraflam-THPC crosslinks permanently to the fabric, resulting in a finish that remains effective even after 50 or more industrial launderings.
- ▶ **Fabric Integrity:** Saraflam-THPC finish result in a soft hand-feel and significantly lower tear strength loss, making it ideal for everyday apparel, children's sleepwear, workwear, and military uniforms. Because curing happens at ambient temperatures with gas rather than extreme heat, the fabric retains its natural drape, softness, and tensile strength.
- ▶ **Low Toxicity:** Saraflam-THPC is considered low-toxic and biodegradable, making it a safer and more environmentally friendly alternative in modern industrial processes.

▶ **APPLICATION STEPS**

- ▶ **Padding:** Cotton fabric is passed through an aqueous pad bath containing the THPC-urea pre-condensate.

- ▶ **Drying:** The fabric is dried carefully to control moisture levels (typically around 10-15%) before the ammonia treatment.

- ▶ **Ammonia Curing:** The dried fabric is passed into an ammonia chamber where it is exposed to gaseous ammonia. This instantly polymerizes and insolubilizes the resin within the cotton fibres.

Unlike conventional high-temperature heat-curing (which can cause fabric stiffness and weaken the cotton), this process uses gaseous ammonia. The dried fabric is exposed to ammonia gas at ambient or slightly elevated temperatures. The ammonia acts as a catalyst, rapidly reacting with the THPC-urea pre-condensate to form an insoluble, three-dimensional, cross-linked polymer within the cellulose matrix of the cotton.

- ▶ **Oxidation & Washing:** The fabric is oxidized (often with hydrogen peroxide) to convert any residual phosphorus to stable phosphorus, followed by washing to remove unreacted chemicals, and final drying.

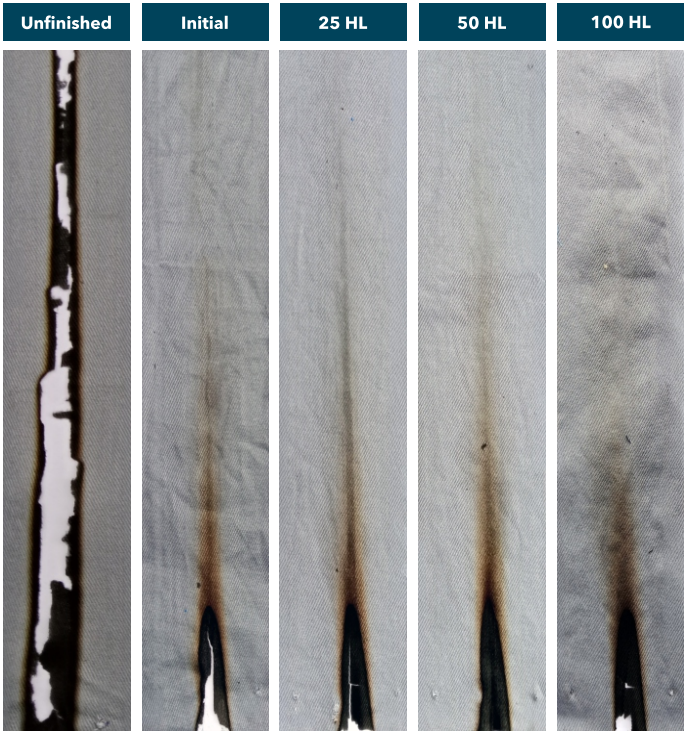
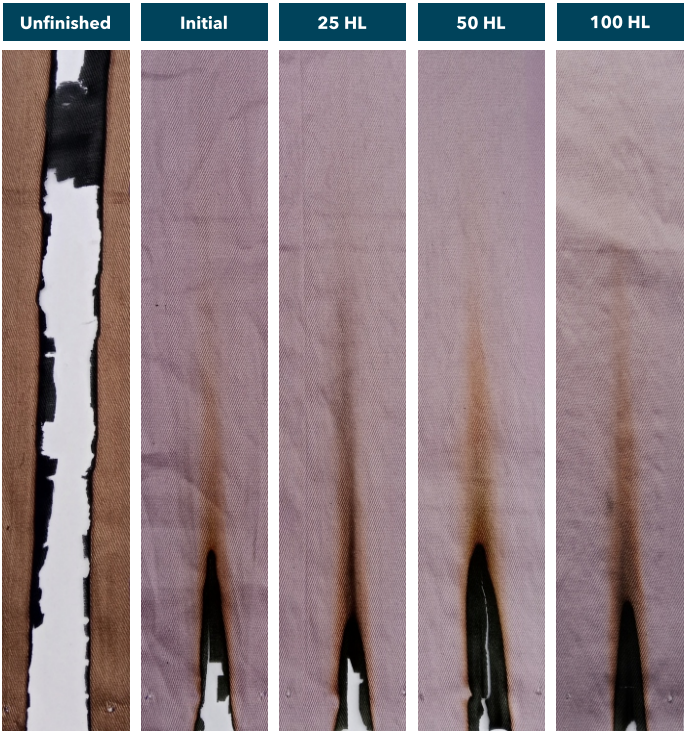
EVALUATION METHODS

Fabrics were padded with 70% expression (0.2kg Pressure) and dried at 120°C for 2 min. and subjected for ammonia curing. Ammonia cured fabrics were then evaluated for flame retardancy as per ASTM D 6413. Fabrics were washed for 25 HL, 50 HL and 100 HL as per ISO 6330: 2021 - 4N.

Flame retardant properties of finished fabrics (ASTM D 6413)

Unfinished : 100% Cotton fabric				
		Char length, cm	After flame time, sec.	Glow time, sec.
Unfinished		Complete Burn	12-13	50-51
600g/l Saraflam-THPC + 5g/l IPA	Initial	7.0	0	0
	25 HL	4.5	0	0
	50 HL	7.5	0	0
	100 HL	5.4	0	0

Unfinished Fabric : Cotton/Nylon - 70/30 Blend fabric				
		Char length, cm	After flame time, sec.	Glow time, sec.
Unfinished		Complete Burn	15-16	>3 min
660g/l Saraflam-THPC + 5g/l IPA	Initial	4.9	0	0
	25 HL	5.3	0	0
	50 HL	6.2	0	0
	100 HL	5.0	0	0



► CONCLUSION

Fabrics finished with Saraflam-THPC shows outstanding flame retardancy and highly effective even upto 100 Home laundering. Saraflam-THPC, a THPC-urea-based formulation provides an exceptional balance between outstanding flame retardancy and maintained textile integrity. Through the in-situ formation of insoluble cross-linked polymers via the pad-dry-cure and ammonia fixation process, the phosphorus and nitrogen species are securely covalently bonded to the cellulose structure. This ensures that the treated fabrics exhibit superior washing durability, maintaining self-extinguishing capabilities even after repeated laundering while preserving critical physical properties of the fabric. As the industry shifts away from bio-accumulative halogenated alternatives, advanced THPC-urea systems offer a highly effective, chemically stable, and environmentally responsive approach to improving the fire safety of cellulosic and synthetic-blend materials.



WIPEOFF-SF

Soil Release Finishes For Textiles

Soiling generally means smearing or staining of a large surface of the fabric with dust or dirt and oil or grease or both. The problem of soiling is not a new one. Natural fibres and synthetic fibres both attract dirt and get soiled but synthetic fibres attract soil to a greater extent than natural fibres; apart from this, they do not release soil easily during washing. Due to absorption and retention of soil, the whiteness and brightness of a fabric is spoiled and it appears yellowish and dirty.

Mechanism of soiling

A fabric gets soiled mainly by three types of mechanism.

- ▶ **By mechanical adhesion of soil to the cloth** by direct contact with a soiled surface or by rubbing of the garments against the skin or picking up dirt from liquors or from air; fabric construction facilitates such adhesion as the soil gets entrapped in inter-fibre and inter yarn spaces or even into the capillary spaces of the fibre where it gets firmly deposited. Also soil which is oily in nature can diffuse into the fibre.
- ▶ **By adhesion by electrical forces** due to attraction of dust particles from air by electrically charged fibre surface. This phenomenon occurs mainly with synthetic fibres because of their low moisture regain. Positively charged fabric surface is soiled more than negatively charged surface.

- ▶ **By re-deposition of soil during washing** which occurs particularly with nylon and polyester fabrics; the redeposition on these fibres takes place because of their oleophilic nature. Another aspect of soiling is the effect of time lag between soiling and washing. When a soiled fabric is allowed to lie unwashed for many days, the soil diffuses inside the fibre and it becomes difficult to remove it.

Soil Release

Soil release is a chemical finish that permits relatively easy removal of soils with ordinary laundering. The soil releasability characteristics of a given textile depend on the kind of fibres from which it is made and the kind of finishing agent which has been applied to it. Natural fibres such as cotton and wool exhibit little soil repellency, but when they do become soiled they are readily cleaned, as they exhibit a high level of soil releasability. Some of the synthetics, notably polyester, exhibit not only a low level of soil repellency but also a low level of soil releasability. Thus, the trend towards fabricating textiles from blends of cotton or wool with polyester has aggravated the situation, because such blends are easily soiled and the absorbed soil is difficult to wash out. Even fabrics made from natural fibres become somewhat hydrophobic after durable press finishing and are difficult to clean. Several soil-release compounds can be used, which mostly increase hydrophilicity of textile materials.

Soil release finishes are therefore necessary because hydrophobic fabrics, including fabrics treated with durable press finishes, have very low water absorbency. In these cases, soil release finishes accomplish the tasks of making the fibres more absorbent (hydrophilic), thus permitting better wettability for improved soil removal. It should be emphasized that, in contrast to soil repellent finishes, a soil release finish does not prevent initial soiling but merely enables deposited dirt to be removed in laundering. Other fabric properties that are enhanced by soil release finishes include protection from soil redeposition during laundering and absorbency or transport of liquid water.

In terms of application fields, soil release finishes were first introduced and aimed to eliminate laundry problems of durable press fabrics. Tablecloths and men's shirts were the first articles treated with the new finishes. Today, fabrics treated with soil release finishes are particularly suited for active wear and leisure wear markets that are continuing to grow in importance. Industrial uniforms, apparels, napery, upholstery are other market areas where soil release is a desirable product feature. Moreover, soil release finishes are particularly useful where the market demands are for white and pastel coloured garments.

With this background, Sarex has developed a product Wipeoff-SF, a soil release finishing agent. Wipeoff-SF is soil release finishing agent related to the easier removal of soils during home laundering conditions. It does not prevent initial soiling of the garment. The easy removal of dirt during laundering is achieved by increasing the hydrophilicity and swelling of fibres, hence allowing easier detergent penetration between the soil and the fibre.

Following mentioned are some of the unique features of the product:

► **UNIQUE FEATURES**

- Prevent dirt from attaching to the clothes, making it easier to wash it off in the washing cycle.
- Suitable for greasy stains (e.g. cosmetics), food stains (water and oil based).

- Greasy stains (e.g. lipstick, kohl etc.) can be easily wiped-off or cleaned from the fabric with wet cloth.
- Enhanced hydrophilicity and wicking property of the fabric.
- Imparts comfort finish along with soil release property.
- Suitable for apparel fabrics, upholstery fabrics, carpets, tablecloths, napery.

► **APPLICATION**

- **Wipeoff-SF is suitable for padding process:**

Recommended dosage : 50-100 g/l
pH adjustment : 5-6
% Pick-up : 60-80%
Drying and Curing : 150-180°C

► **EVALUATION METHODS**

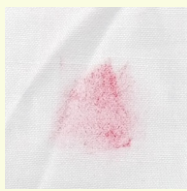
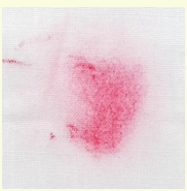
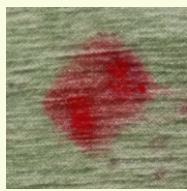
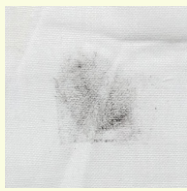
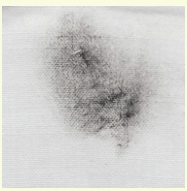
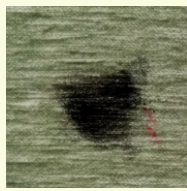
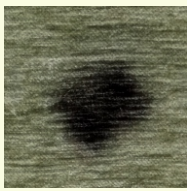
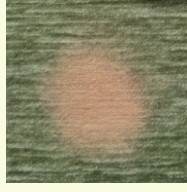
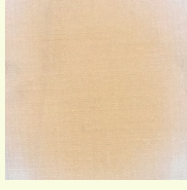
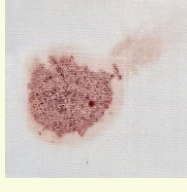
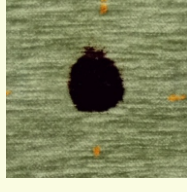
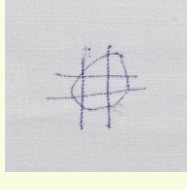
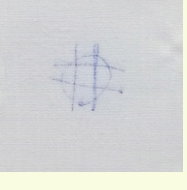
The soil releasing efficacy was evaluated by wiping the stains with wet cloth. Also the soil releasing efficiency was evaluated by standard AATCC Test Method 130-2000, which is designed to measure the ability of fabrics to release stains during home laundering.

► **CONCLUSION**

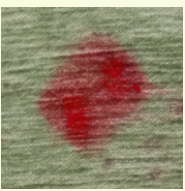
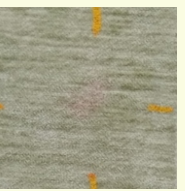
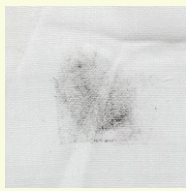
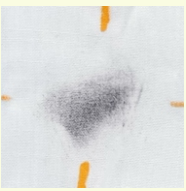
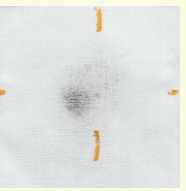
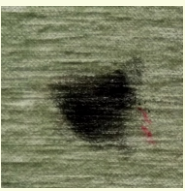
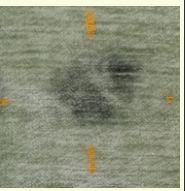
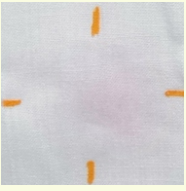
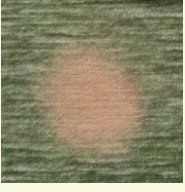
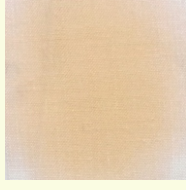
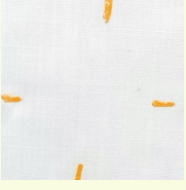
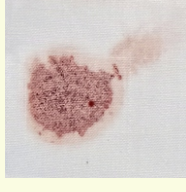
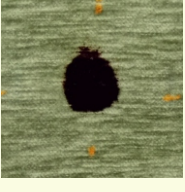
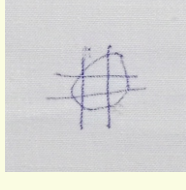
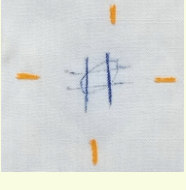
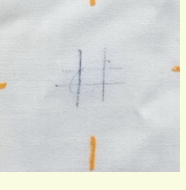
The integration of Wipeoff-SF, hydrophilic soil release finishing agent, represents a vital advancement in textile technology, effectively bridging the gap between aesthetic appeal and practical everyday wear. By successfully converting water-repelling (hydrophobic) synthetics like polyester into water-loving (hydrophilic) surfaces, this product allow aqueous detergents to easily displace and wash away stubborn stains. As consumer demand for "easy-care/easy-wash" active wear and everyday apparel grows, these chemical treatments not only elevate the longevity and cleanliness of garments but also ensure superior comfort and sustainability in the long term.

► **PERFORMANCE DATA OF WIPEOFF-SF**

Stain wiped-off with wet cotton fabric

Stains	Original	Unfinished	Finished	Original	Unfinished	Finished
Lipstick						
Kohl / Kajal						
Blush						
Compact						
Chilli Oil						
Chocolate						
Ball pen						

Soil release efficiency : AATCC Test method 130 - 2000

Stains	Original	Unfinished	Finished	Original	Unfinished	Finished
Lipstick						
Kohl / Kajal						
Blush						
Compact						
Chilli Oil						
Chocolate						
Ball pen						



DYEWELL-872

Leveling Agent For Polyester Dyeing

Disperse dyeing of hydrophobic synthetic fibres is normally done by the immersion of the material to be dyed into an aqueous dye bath which contains the dyestuff and various additives and auxiliaries. In this procedure it is important to obtain a reproducible exhaustion of dye from the bath to the material and obtain a uniform distribution of the dye on the material. This can be done by dyeing at temperatures in excess of 100°C (typically 125-135°C). The levelling agent in polyester dyeing enhances dye migration without substantially accelerating the exhaustion of dye onto the fabric being dyed. It also involves a process for improving the levelness of already dyed materials by subjecting them to temperatures above the boiling point of water in the presence of levelling agents. Naturally such dyeing must be done in pressurized equipment. Alternatively, the dyeing can be done with the addition of leveling agents to the dye bath.

A leveling agent for disperse dyeing is a specialized textile auxiliary essential for achieving uniform color distribution and preventing defects like streaks or spots. It works primarily by slowing down rapid dye absorption (retardation) and promoting the redistribution of dye molecules from darker to lighter areas on the fabric (migration).

Because disperse dyes are practically water-insoluble and the fibres they colour are highly hydrophobic, these specialized leveling agents are specifically engineered to interact dynamically with both the dye and the textile. As the dye bath is heated to high temperatures (often

around 130°C), the leveling agent helps moderate the rate at which the dyes exhaust onto the fabric, allowing the dye molecules to move and reposition themselves evenly. It functions by either momentarily forming soluble complexes with the dye molecules or by competing with them for absorption sites on the fibre, effectively retarding the initial dye strike. This ensures that the dye molecules are given ample time to migrate and diffuse completely into the amorphous regions of the synthetic polymer before fixation takes place. Furthermore, leveling agents stabilize the dye bath by preventing dye aggregation, minimizing oligomer deposition, and guaranteeing optimal reproducibility, which ultimately leads to right-first-time dyeing and enhanced overall colour fastness.

Leveling difficult, hard-to-migrate disperse dyes on synthetic fabrics like polyester requires strict control of the dyeing process. The most effective approach involves selecting temperature-compatible dye mixtures, utilizing non-ionic leveling agents, and applying a strict, gradual heating rate (1-1.5°C per minute) to high-temperature/high-pressure (HTHP) dye baths. Sarex has developed a product **Dyewell-872** which is especially suitable for the leveling and migration of difficult shades. Difficult disperse dyes (such as large-molecule or high-energy dyes used for deep shades) tend to exhaust rapidly or crystallize at elevated temperatures. Dyewell-872 combines retarding and migrating properties to prevent the instantaneous, uneven exhaustion of dye at high temperatures (around 130°C).

► **UNIQUE FEATURES**

- Leveling agent for high temperature polyester dyeings.
- Equalizes the strike rate of different classes of disperse dyes at high temperature enabling migration and level dyeing.
- Very good migration and suitable for faulty dyeing corrections.
- Improved dispersion ensure uniform and level dyeing.

► **APPLICATION STEPS**

- **In Exhaust dyeing of Polyester tops, Yarn, Fibre & Fabrics**

Set the bath with following

Dyewell-872 : 1 - 1.5%
Saracid-RS (Acid buffer) : 0.5 - 1.0g/l

Circulate at 60°C for 5-10 min., add dyestuff dispersion, circulate for 5-10 min. Check and adjust pH to 4.5 - 5.5 and dye as per usual method.

► **For correction of Faulty Dyeing's and Levelling**

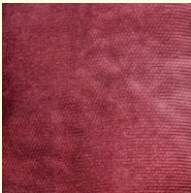
Dyewell-872 : 1 - 2 %
pH : 4.5 - 5.5

Treat at 130°C for 40-60 min. Drain and reduction clear.

Performance data

Polyester fabric was dyed with combination disperse dyes as per the regular disperse dyeing recipe. For the migration study, 1 gm dyed and 1 gm undyed fabric is taken together and treated with 2% Dyewell-872 at 130°C, 30 min. at M:L - 1:20, pH 4.0 - 4.5 with 2°C/ min. as the rate of heating.

Migration study

Dyestuff : 0.8% C.I. Disperse Maroon 30 + 0.5% C.I. Disperse Blue 183 + 0.5% C.I. Disperse Red 343		
Dyed	Undyed	
		Blank
		2% Dyewell-872

Dyestuff : 0.8% C.I. Disperse Orange 61 + 0.3% C.I. Disperse Blue 354		
Dyed	Undyed	
		Blank
		2% Dyewell-872

► **CONCLUSION**

Dyewell-872 is an effective leveling and migrating agent for high temperature polyester dyeing which stabilizes the dye dispersion to inhibit agglomeration, ensuring uniform absorption across polyester fabrics and preventing blotchiness or faulty dyeing.

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