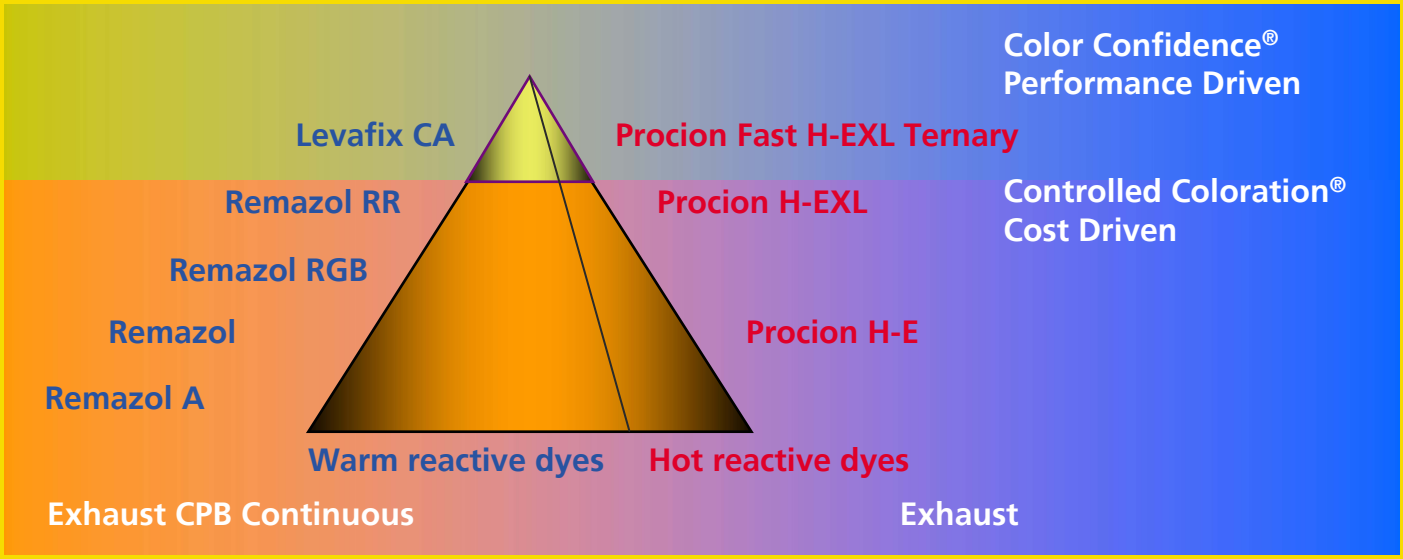
# Illustration of the hot dyeing segment Procion® H-EXL

# The Market for Reactive Dyes




## Where are the features of hot exhaust dyeing technology of benefit?

## Where migration and high temperature assist optimum dyeing performance in the following challenging circumstances:

| | |
|---|---|
| • Single Jersey cotton / elastane<br>• Viscose woven and knitgoods<br>• Mercerised cotton Single Jersey | Difficulties when rope dyeing on jet machines due to physical restriction of fabric and / or high affinity of dye for fibre. |
| • Lyocell | High affinity fibre requiring high migration system |
| • Hank dyeing of mercerised cotton | Limited flow on cabinet type machines requires high migration system to avoid "stick marks" |
| • Garment dyeing | Seam penetration and elasticated cuffs / components |
| • One bath 2 stage PES / cellulose | Minimal temperature differential between polyester and cellulose phases and alkali fixation also provides clearing of disperse dyes cross-staining on cellulose |
| • High density package dyeing | Penetration difficulties causing shading in to out of package |
| • Post mercerization | For post mercerization, but also for any other post treatments which require stability to hot alkaline liquors |

DyStar Shaping Success

# What are the Critical Success Factors?

- Substantivity equilibrium ~75% to achieve a level dyeing at this critical stage before addition of alkali (which promotes further secondary exhaustion and simultaneous fixation)
- Diffusion of dye into fibre and out of fibre to provide mobility of dye molecules
- Temperature of 80 °C (or migration temperature of 95 °C) plus to swell the cellulosic fibre and open the capillaries for migration into fibre and out of the fibre. The reactive dye substantivity is reduced with increasing temperature thereby enhancing migration potential
- Reduced viscosity of water at 80 °C plus improves penetration in high density yarn package dyeing
- Reconfiguration of the fabric rope is facilitated by running at higher dyeing temperatures
- Low reaction rate of MCT-cellulose covalent bond formation allows secondary exhaustion (E-S) before significant fixation of the dye
- Hot rinsing ~ 70 °C immediately after dyeing without the necessity to cool or neutralise maintains the open cellulose structure and excellent diffusion-out of any unfixed dye, simultaneously with dilution of electrolyte and alkali

# Procion H-EXL

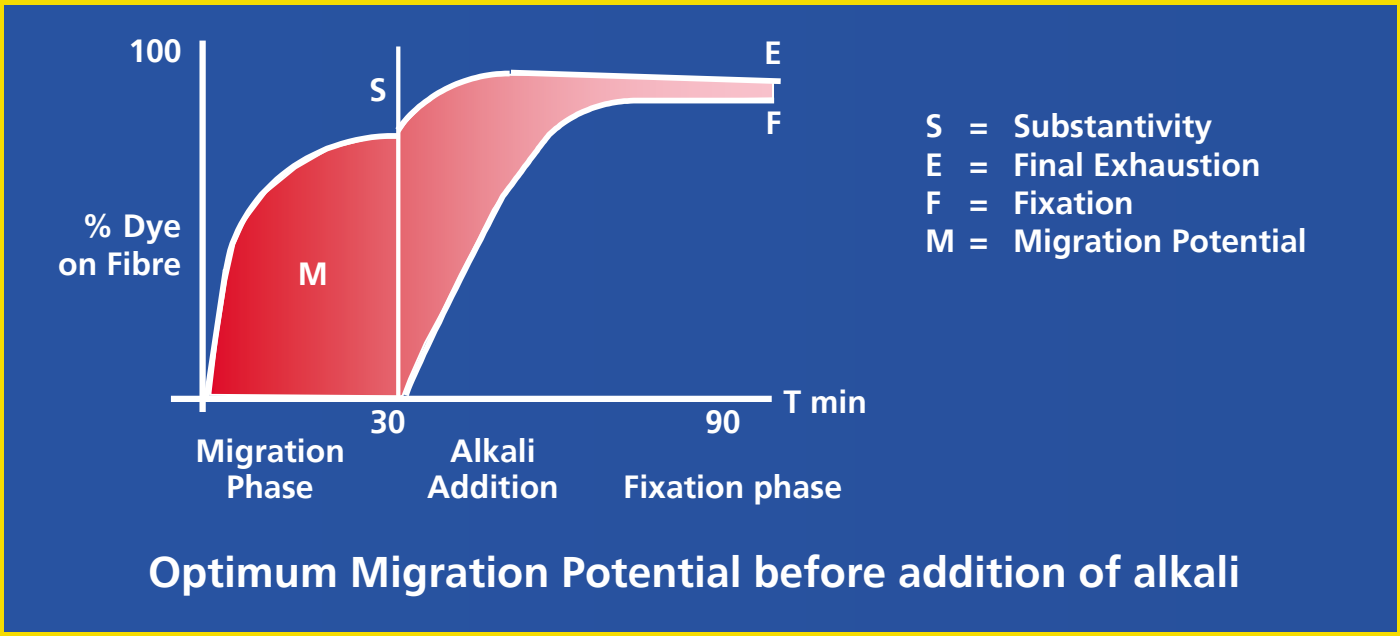
# The leading Hot Dyeing Range for Critical Substrates

## Dye Profile

**For critical substrates such as listed, it is recommended to use a high neutral substantivity reactive dyeing system, with high diffusion and migration properties to ensure ~ 75% of dye applied at the exhaust phase is perfectly level before addition of alkali for the fixation phase.**

**On controlled addition of alkali there should only be ~ 15/20% further exhaustion of dye and a gradual fixation with the cellulose fibre.**

**The following diagram illustrates the target values for neutral substantivity and migration potential before addition of alkali to further exhaust and simultaneously fix the reactive dye on the fibre.**




Optimum Migration Potential before addition of alkali

# Migration

**The dyeing temperature of 80 °C (or migration temperature of 95 - 105 °C in certain circumstances) opens the interstices of the cellulose fibre and permits diffusion into and out of the substrate being dyed.**

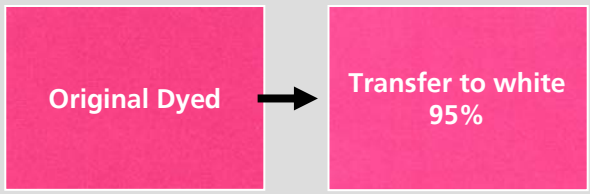
**To ensure a perfectly level dyeing in the difficult circumstances described, at least ~ 75% of the dye should be on the fibre and therefore available for migration / diffusion.**

**The illustrations show perfect mobility of the dye during this phase in piece, yarn package and garment dyeing.**

S: Substantivity 75%

E: Exhaustion 95%

Migration Test 30 min 95 °C




Migration Potential from dyed to undyed fibre

Migration potential
Package Dyeing
Density 380 g/l
20 l/kg/min Flow
10 : 1 LR

2% Procion Crimson H-EXL dyed with salt. Rewound together with white Yarn before migration phase

Migration Phase
30 min 95 °C

Result after migration and fixation phase

Warm Dyeing 60 °C
Partial Seam penetration

Hot Dyeing 80 °C
Full Seam Penetration

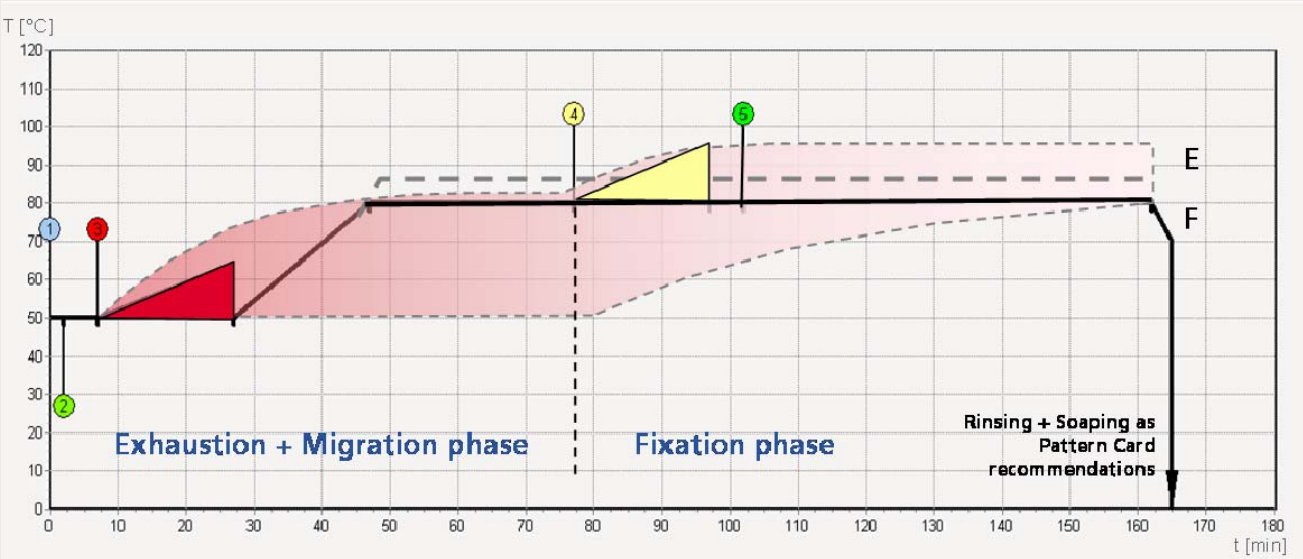
Illustration of Seam Penetration in Garment Dyeing

## Dyeing Process

**The high migration properties permit the addition of electrolyte at the start of the process together with dyeing auxiliaries such as fibre lubricant and / or sequestering agent.**

**After checking the specific gravity (salt concentration) and pH to ensure Controlled Coloration® the dye is added from a calculated volume of water (to maintain final liquor ratio) over 10 - 20 minutes by linear addition profile and the temperature then raised to the required set level. The higher temperature used in the Migration Process permits the greatest mobility of dye when required for the most challenging circumstances.**

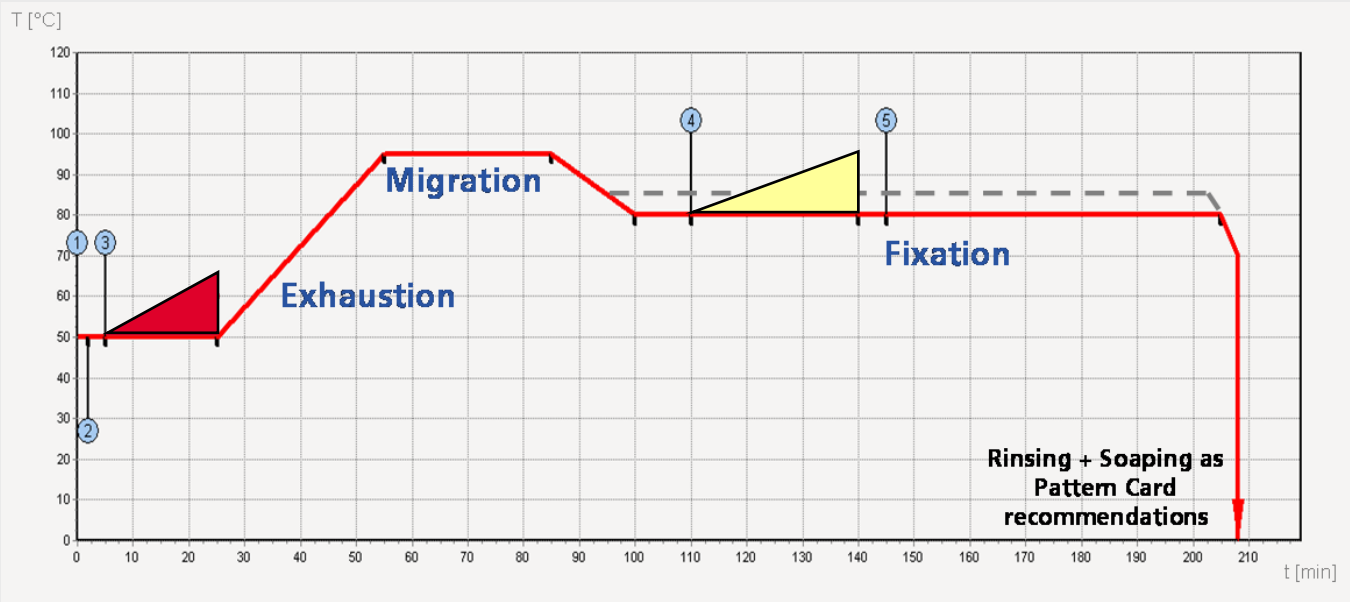
## Temperature Rise Process 80/85 °C




1 Salt, auxilliaries
2 Salt specific gravity check, pH 5.5 - 6.5
3 Dye dosing
4 Alkali dosing
5 pH check 10.8 - 11.2

**Auxiliary recommendations**
**Lubricant: Sera® Lube M-CF**
**Sequestering Agent: Sera® Quest M-PP**
**Soaping Agent: Sera® Fast C-RD or Sera® Sperse C-SN**

# Migration Process 95°C

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