BEN-COLOUR
Dyeing systems.
Benninger’s dyeing technology fully satisfies these high requirements. As a competent supplier of a comprehensive range of textile wet finishing plants we already put emphasis on the quality requirements of dyeing in the pretreatment of the fabric, by the BEN-BLEACH concept and the BEN-DIMENSA mercerizing range.

Dyeing is a very demanding task, as the quality of dyeing is to a great extent visible, recognizable by the human eye. Furthermore, correction of rejects is rather time consuming and costly. This makes the dyeing process one of the most delicate wet finishing processes.

For any continuous or semi-continuous dyeing process in open width, Benninger is your reliable partner. The undisputed high standard of the applied technology, of the design and the workmanship of Benninger’s machinery and plants enable you – our customers – to economically produce best dyeing quality. And this comprehensively, be it CPB-dyeing, PAD-DRY/Thermosol, Pad-Steam, or post-treatment in the washing section.

<table>
<thead>
<tr>
<th>Dyestuff class</th>
<th>Process</th>
<th>Fabric</th>
<th>1 DyePad</th>
<th>2 Air Passage</th>
<th>3 Thermray IR-Dryer</th>
<th>4 Thermfix Hotflue</th>
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<tbody>
<tr>
<td>Reactive Dyestuff</td>
<td>Cold Pad Batch</td>
<td>Cotton</td>
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<td>Pad-Dry/Pad-Steamp</td>
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<td>Pad-Steamp all in</td>
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<td>Pad-Dry Thermofix</td>
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<td>Pad-Humidity Control</td>
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<td>Vat Dyestuff</td>
<td>Pad-Dry/Pad-Steamp</td>
<td>Cotton</td>
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<td></td>
<td>Pad-Steamp (wet/wet)</td>
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<td>Sulphur Dyestuff</td>
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<td>Cotton</td>
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<td>Naphtol Dyestuff</td>
<td>Pad-Dry Pad Develop</td>
<td>Cotton</td>
<td>Naphtolate</td>
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<td>Electric IR-Drying</td>
<td>Drying</td>
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<td>Reactive Disperse Dyestuff</td>
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<td>Cotton/Polyester</td>
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<tr>
<td>Vat Disperse Dyestuff</td>
<td>Pad-Dry Pad Develop</td>
<td>Cotton</td>
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Process overview
Flexible layout design enables tailormade plants for any dyeing processes, extendable at any time. A DyePad padder station and an EXTRACTA washing range already are sufficient for a semi-continuous CPB dyeing plant for 100% cotton. Further additional plant elements are however required for Co/PES or for continuous processes.

The DyePad padder or a booster for addition of fixation chemicals and a REACTA dyeing steamer for fixation by wet steam method converts the CPB-plant to a PAD-STEAM dyeing plant. For Co/PES a PAD-DRY (PAD-THERMOSOL) dyeing plant is additionally required, comprising a dry section with IR-dryer and HOTFLUE THERMOSOL chambers.

Requirements for continuous dyeing:
- Uniformity of the dyeing
- High color fastness
- Short through time
- Cost efficient process
- High efficiency
- Flexible plant, suitable for many processes
- Crease-free fabric run
- High reproducibility
The Küsters DyePad station with its flexible S-Roll Technology can dye woven and knitted goods, in reproducible and premium quality. Moreover the Küsters DyePad offers great flexibility due to the correction potential of the two S-Rollers. This means an attractively priced, simple to operate, reliable and economical Padder station able for diverse handling.

Versatility of the Küsters S-Roll
Owing to its design and construction, Küsters high efficiency padders meet all practical requirements for application in modern processing. Different feeding systems, squeezing roll coverings, trough shapes as well as expanders and spreaders allow a variety of woven and knitted goods to be treated.

A uniform liquor application over the fabric width, as well as a selective liquor application to the selvedge – center – selvedge zone can be easily set, reproduced and program controlled if required.

This may become necessary owing to varying absorption capacity, fabric tension, weft distortion and humidity (at the beginning of the process) as well as faults arising in subsequent processes, like dyestuff migration at the selvedges during drying.

System benefits
- The right concept for every kind of fabric by appropriate roll coverings, trough design, as well as expanding and spreading devices
- Uniform linear liquor application by two deflection-controlled rolls throughout the entire batch
- If requested, varied liquors or chemicals can be applied over the length and width of the batch and also programmed via the PLC, by an adjustable squeezing effect with one deflection compensating roll
- Reproducibility of all dyestuff and chemical applications
- No cambering of the squeeze rollers
- Uniform squeezing pressure within the fabric area including thick and narrow webs (without selvedge pressure)
- No side-to-center shading, due to smooth treatment of the selveges
- Simple operation and control due to clear design

Advantages
- Low energy consumption
- Short return on investment
- Completely reliable and maintenance-free
- Reduction of setting-up-time through an automatic quick cleaning system

Correction diagram

New Küsters S-Roll with double correction potential
- Greater flexibility for the dye producer
- Enhanced reproducibility with electronic pressure control
Küsters S-Roll Technology

The S-Roll as the heart of the overall system enables accurate reproducible results due to its user defined capabilities, to define pressure application possibilities to the two S-Rolls. By means of an intelligent software support system, a uniform dyestuff application is guaranteed, this means versatile requirements in relation to quality and material can be achieved.

The deflection-controlled roll for constant results
Küsters Padders are equipped with the well-known “Swimming Roll” (S-Roll) Küsters Technology. With controlled linear pressure the deflection-controlled rolls achieve a specific squeezing nip for every fabric.

Technical data

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<tr>
<td>Number of S-Rolls</td>
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<td>Working width (mm)</td>
<td>1600–2600</td>
<td>2400–3600</td>
</tr>
<tr>
<td>Diameter of S-Rolls (mm)</td>
<td>220</td>
<td>300</td>
</tr>
<tr>
<td>Max. linear pressure (N/mm)</td>
<td>15–50</td>
<td>12–50</td>
</tr>
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</table>
Padder alternatives and trough shapes

Modular design and construction enables all practical requirements for application in modern processing. All concepts are aligned to supply economically and technologically, the best possible solution for our customers.

**Trough shapes**
Special displacement elements and lay-on rollers in U-shaped troughs permit low liquor contents and accordingly fast liquor exchange. This also prevents any undesired changes in the concentration. Furthermore the low liquor content has a positive effect on the exchange of liquor with minimum dyestuff and chemical loss. All troughs can be raised and lowered pneumatically.

**Roller adjustment**
The application determines the roll covering, the trough shape and the expander unit. The possibility of adjusting the roller position means that the new DyePad padder offers absolute flexibility. As a universal core unit, the DyePad is able to meet all textile processing challenges.

**Nip dyeing**
Besides this type of trough, the well-known wedge shaped trough can be installed for specific applications. In this case, the fabric is guided from top to bottom through a horizontal roller nip. Passing through a trough is alternatively possible.
Contidos SF dosing station

The Contidos SF dosing station guarantees accurate reproduction at a premium quality as well as consistent process management. The system efficiently controls the entire dyeing process through automatic monitoring and online dosing.

Mastering the CPB reactive dyeing process goes way beyond the flexing compensation of the rollers and their correction possibilities. The target of the dye producer is to have an accurately reproducible process management. This is accomplished by temperature management and innovative dosing concepts.

Temperature management
Season and geographically independent, constant and reproducible application and batching temperature.

Dosing to measure
- Online dosing for CPB dyeing with padder
- Production of dye liquor on the basis of dye solution and auxiliaries dispensed separately
- Dye solution and auxiliaries are blended homogeneously in a mixer and fed into the padder
- Dosing of each individual component according to a formula in ml per liter of dye liquor
- Metering of liquor pick-up
- Record of consumption
- Automatic operation mode
- High accuracy in dye liquor production, with automatic control of dosing tolerances
- Simple and rapid color changes
- Small loss of dye liquor and short rinsing-times in the case of color changes
- No preparation of auxiliary baths
- Dosing capacity according to a recipe and production capacity
- PLC control with operator terminal
- Link to process control system
- Dissolving and preparation unit available

Modern concept for Cold Pad Batch (CPB) reactive dyeing
The complexities of the textile challenges, require custom-made concepts and innovative detailed solutions, regarding construction and procedure.
REACTA
Dye steamer

The liquor pick-up can be adjusted from 70–130%. The economiser trough with swivelling trough roller is distinguished by a low liquor volume of only 14 l/m. Because of the quick liquor turnover, possible errors in the initial filling have almost no effect and deviations over length are avoided. The displacement body can be pneumatically lifted for easy cleaning of the BOOSTER.

Perfect fixation of dyestuff in the REACTA
Constant saturated steam conditions are the essential prerequisite for perfect dyeings and their reproducibility.

Benninger feeds to steam for humidity control through a steam conditioning station. Hence, the steam enters the REACTA dyeing steamer in perfectly saturated condition. The steamer design and the positioning of the steam condition monitoring warrant absolute absence of air in the steamer. Even minimal deviations lead immediately to an automatic correction of the steam feed.

Geometry and drive system of the REACTA ensures crease free cloth run. The rollers are with large diameters of 193 mm, and are individually driven by maintenance free AC-motors. Very precise drive control is ensured via load-cell equipped measuring rollers and frequency converters. Tension differences caused by shrinking or stretching of the cloth in the steaming process are equalized immediately.

The distance from either the DyePad or the BOOSTER is kept very short for the dyestuff development. At the entry of the fabric into the steamer, a lip heating and an exhaust suction fan for excess steam prevent condensate drops at the entry area. The steamer roof is heated; roof and front and back side are well insulated. The water lock at the steamer exit is a critical part of equipment for a successful process. The temperature is controlled via the water feed and low water volume ensures constant process parameters.

The REACTA steamer has good access and can be cleaned easily. An automatic cleaning device is optionally available.

- Cylindrically ground soft rubber rollers
- Liftable liquor displacement body
- Chemical feed distributed over entire fabric width

BOOSTER for equal and uniform liquor application
The special squeeze nip of the BOOSTER guarantees a uniform pick-up, independent from production speed and fabric weight. Linearity of the nip line is ensured despite the freely adjustable nip pressure.

1 Horizontal or vertical fabric entry with heated lips and exhaust fan for excess steam
2 Section with 25 m fabric content
3 Large roller diameter (193 mm) for creaseless fabric run
4 Lifetime lubricated bearings
5 Top rollers individually driven by AC-motors
6 Load cell to measure fabric tension for drive control
7 Roof heating
8 Water seal with small liquor content and uniform liquor distribution
9 Temperature or volume controlled fresh water flow to the water seal
10 Steam conditioning unit
11 Probe to measure the steam condition (below steamer bottom level)
12 Automatic cleaning system (option)
Bifunctional dye steamer

The dye steamer is the core element in the PAD-STEAM fixing process for reactive and vat dyestuffs. But since the PAD-STEAM dyeing plant is often employed as a washing machine on account of flexibility, the dye steamer has to be bypassed or run through without functioning. The REACTA bifunctional Benninger dye steamer can be flooded, so that if needed it serves as a fully effective washing compartment, as for example to pre-rinse CPB reactive dyeings.

**REACTA as washing compartment**
The wash water may be led in countercflow from the following wash compartment, or fed via 2 spray pipes into the water lock. The roller seal is designed so that sealing is assured equally in steam atmosphere or flooded state.

**Good efficiency and economy from short setting-up times**
Production interruptions caused by every change in shade or article are unavoidable in dyeing. Dyeing liquor must be drained and rinsing baths must be renewed. In the event of big differences in shade or deepness even the entire washing zone with all oxidation and soaping baths may be drained and prepared again.

Interruption times are minimized with BEN-COLOUR by following measures (partly optional) and the economy is improved:

- Large drain and feed pipes on all washing compartments
- Low liquor volume (selection of EXTRACTA/TRIKOFLEX models based on process requirements)
- Sectional drain within the washing zone
- Automatic emptying and filling
- Automatic heating-up cycle
- Automatic cleaning device for dyeing padder and REACTA steamer
- Good accessibility, no dead corners, large windows, easy opening covers with hinges and springs, no pumps
Continuous PAD-STEAM process

- Padding (1 or 2 baths)
- Steaming
- Oxidation/soaping
- Drying

Semi-Continuous Process

- Padding
- Batching
- Rinsing and soaping with immersion store

Continuous PAD-DRY and PAD-STEAM process

- Penetration and IR-predrying
- Steaming
- Drying and/or thermofixation
- Cooling
- Padding (1 or 2 baths)
Continuous PAD-STEAM process
This example shows a small PAD-STEAM dyeing range. The advantages of the continuous dyeing process and the flexibility of a small size range are here combined!

Possible applications
- PAD-STEAM process for vat and reactive dyestuff (PAD-DRY is carried out in a separate range)
- 1-bath (all in) PAD-STEAM process with sulfur dyestuff (cotton)
- 2-bath (wet/wet) PAD-STEAM process vat dyestuff (cotton)
- 1-bath (all-in) PAD-STEAM process with reactive dyestuff (cotton)
- 2-bath (wet/wet) process with direct dyestuff (cotton)

Continuous PAD-DRY and PAD-STEAM process
The range is separated into a PAD-DRY and a PAD-STEAM part. Both parts can run separately or in line. The NW-EXTRACTA washing section can run separately as well. This range is optionally equipped with a winding station for COLD PAD BATCH dyeing.

Possible applications
- PAD-DRY/PAD-STEAM process with reactive or vat dyestuff (cotton)
- PAD-THERMOSOL/PAD-STEAM process with reactive and disperse dyestuff (cotton/polyester)
- PAD-THERMOSOL/PAD-STEAM process with vat and disperse dyestuff (cotton/polyester)
- PAD-DRY/THERMOFIX process with reactive dyestuff (cotton)
- PAD-DRY/PAD-DEVELOP process with naphtol dyestuff (cotton)
- COLD PAD BATCH dyeing process with reactive dyestuff (cotton)
The Swiss company Benninger has been the textile industry's leading partner across the globe for one hundred and fifty years with global branches and service representatives. Benninger develops and manufactures textile finishing and cord production ranges as well as providing complete system solutions. As the market leader Benninger will continue to rely on its comprehensive process know-how in order to be able to offer high-quality installations with excellent customer service.