COMPANY HISTORY

COMPANY WITH TRADITION AND FUTURE

Established in 1959, Dhall is one of the world’s leading manufacturers of finishing and processing machines and still a family owned company. Dhall has a proven track record of over 50 years in delivering world-class products to more than 2000 satisfied customers in India and over 30 countries world-wide including Japan, Australia, United Kingdom, Bangladesh and Thailand. Dhall’s list of international customers includes well-known premium textile industry leaders such as Arvind, Raymond, Alok Industries, Bombay Dyeing, Pradeep Overseas and Nahar Group in India, and Sunflag Industries (Nigeria), Ha-meem, Rahim Group (Bangladesh), Toray Group (Japan) and Bradmill (Australia) in the international textile markets. DHALL's product portfolio contains the following machine range: Continuous Bleaching, Washing and Mercerizing, Pad Dry and Pad Steam Ranges, Cold Pad-Batch Dyeing ranges with S-ROLL padder, S-ROLL dye & finishing Padders, Jigger, Drying Ranges, Stenter & Relax dryers, Shrinking Ranges and Vacuum Foam Finishing Ranges. Dhall Group also offers ZIMMER (USA) – DHALL rotary nickel screens developed using the latest technology from Zimmer-USA and highest quality standards to deliver a world-class product of unmatched performance & quality.

DHALL GROUP deploys the latest trends in manufacturing technology (including CNC lathes, Trumpf laser sheet-cutting, HACO CNC bending) to build our machines at our engineering complex in Ahmedabad, Gujarat. Backed by strong after-sales service and a customer-oriented perspective, Dhall is looking to deliver exceptional value and strong Return on Investment (ROI) for our target customers. In order to develop world-class capabilities in textile finishing and processing machines, DHALL GROUP has formed strategic partnerships with several key industry leaders, such as REISKY MAQUINAS/BRA (former subsidiary of KÜSTERS/GER), ZIMMER/US, MENZEL/US & DOLFUSS MÜLLER/F.
WARP SIZING

Sizing of the warp yarn is essential to reduce breakage of the yarn and thus production stops on the weaving machine. On the weaving machine, the warp yarns are subjected to several types of actions i.e. cyclic strain, flexing, abrasion at various loom parts and inter yarn friction. With sizing the strength - abrasion resistance - of the yarn will improve and the hairiness of yarn will decrease. The degree of improvement of strength depends on adhesion force between fiber and size, size penetration as well as encapsulation of yarn. Different types of water soluble polymers called textile sizing agents/chemicals such as modified starch, polyvinyl alcohol (PVA), carboxymethyl cellulose (CMC), acrylates are used to protect the yarn.
Desizing, irrespective of what the desizing agent is, involves impregnation of the fabric with the desizing agent, allowing the desizing agent to degrade or solubilise the size material, and finally to wash out the degradation products. The major desizing processes are:

- Enzymatic desizing of starches on cotton fabrics
- Oxidative desizing
- Acid desizing
- Removal of water-soluble sizes

**Enzymatic Desizing**

Enzymatic desizing is the classical desizing process of degrading starch size on cotton fabrics using enzymes. Enzymes are complex organic, soluble bio-catalysts, formed by living organisms, that catalyze chemical reaction in biological processes. Enzymes are quite specific in their action on a particular substance. A small quantity of enzyme is able to decompose a large quantity of the substance it acts upon. Enzymes are usually named by the kind of substance degraded in the reaction it catalyzes. Amylases are the enzymes that hydrolyses and reduce the molecular weight of amylose and amylopectin molecules in starch, rendering it water soluble enough to be washed off the fabric. Effective enzymatic desizing require strict control of pH, temperature, water hardness, electrolyte addition and choice of surfactant. In general, the enzymes will be applied in a separate bath, mainly after singeing, and the impregnation of the impregnated fabric is stored onto an A-frame. From a chemical point of view, enzymes can be considered as living organisms, complex proteins, reacting very sensitively towards any changes in their surroundings. Due to that pH, temperature, degree of water-hardness, electrolytes and kind of surfactants have to be checked very carefully to ensure a satisfying effectivity. After a certain dwelling time of 4-6 hours depending on the kind of enzymes, the now degraded sizes can be washed off. The washing off is very important, because residual size can cause multiple problems like patches, reserved parts, lighter shades, moirée, creases, poor absorbency or insufficient degree of whiteness. The size can also be removed continuously by passing through a steamer and remaining in there between 1-2 min at 100°C.

**Acid Desizing**

Cold solutions of dilute sulphuric or hydrochloric acids are used to hydrolyze the starch, however, this has the disadvantage of also affecting the cellulose fiber in cotton fabrics.

**Removal of Water-Soluble Sizes**

Fabrics containing water soluble sizes can be desized by washing using hot water, perhaps containing wetting agents (surfactants) and a mild alkali. The water replaces the size on the outer surface of the fiber, and absorbs within the fiber to remove any fabric residue.
In the textile finishing industry, the preparation step for the bleaching and dyeing of cotton and linen is scouring with the purpose to eliminate the following subsidiaries:

- waxes and greases
- proteins and pectines
- minerals such as Ca, Mg, Fe, Cu
- exycellulose to prevent any damage of the fibre

As a result, the fabric should have a reasonable degree of whiteness and a good absorbency for the following steps dyeing, printing, finishing...

Due to the fact, that scouring depends very much on the penetration of the fabric, it is nowadays mainly done on open-width scouring-ranges.

The standard recipe for scouring consists of the following chemicals:

- up to 25°Bé NaOH (20-80g/l)
- reduction agent
- anionic tenside
- complex builder
BLEACHING

After washing and scouring, the cotton fibre still has its natural yellowish colour and contains multiple contaminations. This can influence dyeing and printing processes and does not meet the requirements for a full white. Therefore the next process of decolorization of greige material in to a suitable material for next processing is called bleaching. Bleaching of textiles can be classified in to:

- Oxidative bleaching
- Reductive bleaching

Generally, oxidative bleachings are carried out using sodium hypochlorite, sodium chlorite or hydrogen peroxide. Natural fibres like cotton, ramie, jute, wool, bamboo are all generally bleached with oxidative methods. Reductive method of bleaching is done with Sodium hydrosulphite, a powerful reducing agent. Fibres like Polyamide, Polyacrylics and Polyacetates can be bleached using reductive bleaching technology.
OXIDATIVE BLEACHING

- HYPOCHLORITE BLEACHING

The conditions of the bleaching agent vary according to the result required, the concentration depends upon the fabric quality, degree of whiteness required, types of machine and the next operation. Normally 2.5-3.0 gpl of available chlorine is sufficient for good bleaching, but it is necessary to optimize it on a possible lower value for a safe bleaching process. In general, the pH range is 10-11 or 10.5-11.5 during bleaching. If the pH reaches 9 then it is a danger level and at 7 pH the bleaching is worse and causes extreme damage to the fabric. The pH value is maintained by adding soda ash or by buffering agent. The suggested temperature for hypochlorite bleaching is 37-40°C. Generally, reaction is accelerated with an increase of temperature.

Nowadays the hypochlorite bleaching process has a minor relevance concerning bleaching processes: By using just hypochlorite on cotton fibers, a so-called “full white” bleaching effect cannot be achieved. Therefore, the hypochlorite bleaching operation is just only used in combination with other bleaching methods.
OXIDATIVE BLEACHING

BLEACHING WITH SODIUM CHLORITE

Sodium chlorite, anhydrous is in the form of slightly hygroscopic crystals or flakes, soluble in water. The hydrated material is in the triclinic leaflets. The chemical formula is NaClO₂. The sodium chlorite is available as a powder, and it is applied under strongly acidic conditions to textiles. Its application produces a toxic and corrosive gas. Sodium Chlorite is an oxidant particularly adapted for synthetic fibre bleaching (polyamidic, acrylic, polyester) and cellulose (man-made and natural, particularly for linen). Its oxidant action works thanks to Chlorine Dioxide which develops through an acidification process; therefore, it is highly recommended to work with closed equipment and to furnish the bleaching departments with aspiration systems. The pH of around 4 +/- 0.2 required for bleaching is maintained with buffers or as termed in the industry activators, like sodium acetate or sodium dihydrogen phosphate (NaH₂PO₄). Latter is usually preferred because it improves whiteness of goods. Neutral or slightly acid chemicals that liberate acid on heating are also used occasionally. Organic esters like ethyl lactate or titrate and their ammonium salts are also suitable for this kind of purpose.

Stabilizers that control chlorine dioxide emission, such as borax or polyphosphates should be used. Since chlorine dioxide is highly corrosive in nature, therefore, it is recommended to use it in fully closed systems, and preferably in fully flooded machines. The gas is also corrosive and results in rusting of stainless steel surface, which stains the material to be bleached. An anti-chlor treatment of fabric bleached with sodium chlorite may be necessary and small additions of sodium bisulphate or thiosulphate to the dyebath will avoid problems with cationic dyes. The sodium chlorite bleaching has the advantages of high brightness degree (especially for acrylic fibres), negligible degradation of fibres (1-2% weight loss for cellulosic fibres and no attack to the polymeric chains in the synthetic fibres), lower environmental impact of wastewaters (negligible level of AOX and COD), it is a versatile bleaching agent for cellulosics, synthetics and blends, especially poly-cotton blends and it is also safe for those synthetic fibres which are sensitive to alkali. Moreover, it is non-sensitive to metal ions such as iron and Water. But there are also disadvantages. Sodium chlorite is expensive as compared to hydrogen peroxide, it can not be used for wool and silk, chlorine dioxide is highly corrosive to metals and also toxic in nature. Bleaching in neutral and acidic pH damage the cotton fibres.
OXIDATIVE BLEACHING

BLEACHING WITH HYDROGEN PEROXIDE

The bleaching bath is composed of hydrogen peroxide (35% or 50% by wt.) as the bleaching agent, an activator (usually alkali) and stabilizers. The hydrogen peroxide bleaching can be done Batchwise, in Continuous or Semi continuous form.

Cotton and Bast fibers are bleached at 80 - 95°C in bath processes, while blends of cotton and regenerated cellulose fibers are bleached at 75 - 80°C. The bleaching time is generally between 2 and 5 hours. In a pressurized high temperature (HT) apparatus cotton can also be bleached at temperatures of 110 - 130°C in only 1 to 2 hours. During the impregnation processes the temperature and as well the retention time varies widely. During a cold bleach process a dwell time of 18 to 24 hours is necessary. In the pad steam process under atmospheric pressure the bleaching time is generally between 1 to 3 hours. The above mentioned processes describe batch processes. Today a lot of continuously, intelligent finishing equipment exists in which the bleaching step is only one of some other treatments and the reaction time of the impregnated material in such steamer is only between 7 to 20 minutes. In general these bleaching process correspond to a preliminary bleach. The pH value depend on the fibres to be bleached and pre-treatment. NaOH is used in case of H₂O₂ bleaching. This is used to bring the pH up to 9-10 because H₂O₂ become active at this pH or oxidation is start at this pH. For the bast fibres, such as linen, weaker alkaline or soda alkaline baths are used in order to avoid a cottonizing. Regenerated cellulose fibres are more sensitive. Therefore, they are only bleached in weak alkaline baths.

Alkali sensitive animal fibers must be bleached in very weak alkaline solutions. Phosphates and ammonia are most widely used as alkalization source. With tetrasodium pyrophosphate simultaneously a stabilization of the bleaching liquor can be attained. High pH and temperature lead to the faster decomposition of peroxide bleaching liquor and degradation of cellulose. The role of the stabilizer is simply to control or regulate these effects the act as buffers, sequestrates and in special cases, enhancing performance of the surfactant used in the bleach bath. For caustic alkaline bleach sodium silicate, organic stabilizers or the combination of both are suitable. In weak alkaline baths the addition of tetrasodium pyrophosphates can be used alone or together with an organic stabiliser.
OXIDATIVE BLEACHING

BLEACHING WITH HYDROGEN PEROXIDE

Most advantages of Peroxide Bleaching process are:
Among the oxidizing bleaching agents, only hydrogen peroxide provides a high bleaching effect at reasonable costs, especially if modern short-term bleaching processes are used with only a few minutes bleaching time. Peroxide bleaching keeps the fibre quality intact. Cotton can be bleached with peroxide in a single stage whereas other processes require two or three bleaching stages (desize with scour, scour with bleach and desize with scour and bleach). No separate pretreatment is necessary because hot, alkaline bleaching has not only a bleaching but also a cleaning effect, it therefore combines the advantages of an alkaline extraction with the bleaching treatment. Animal fibres can only be bleached with peroxide to a high and stable degree of whiteness. The spent peroxide baths still contain residuals of hydrogen peroxide which fever the degradation of the organic impurities in the effluent, and this helps to decrease the chemical oxygen demand (COD). Bleaching of wool with hydrogen peroxide is used after scouring, wool may be bleached by immersion or pad and dry techniques, using alkaline or acid solutions. When used alone, synthetic fibers do not normally require bleaching. However, blends of synthetic fibers with natural or regenerated fibers, e.g. cotton-polyester are frequently bleached. The most popular bleaching agent is Hydrogen Peroxide and it is used in both, batch and continuous processes.
OXIDATIVE BLEACHING

■ BLEACHING WITH SODIUM PERBORATE

Sodium perborate (PBS, NaBO\(\text{3.nH}_2\text{O}\) where n=1 or 4) can readily be incorporated. It has been described as a stable, solid form of hydrogen peroxide allowing its introduction into the wash at the same time as the detergent. Sodium perborate is a gentler bleaching agent than sodium hypochlorite, causing less damage to fabrics and dyes, but by itself is only effective at high (>60ºC) temperatures. Although solid chlorine bleaches exist, they are rarely used in laundry detergents. Water for bleaching should be soft and even hard water can be used but should be free from Cu++ and Fe++.

■ BLEACHING WITH PERACETIC ACID

Peracetic acid is produced by the chemical reaction of acetic acid and hydrogen peroxide. It works in a very narrow pH range of 7 to 8. Below pH 7.0 the bleaching is not proper and above pH 9.0 fiber degradation takes place. Peracetic acid is used as a bleaching agent for nylon and acetate where hydrogen peroxide can not be used.
REDUCTIVE BLEACHING

■ BLEACHING WITH HYDROGEN PEROXIDE

In comparison to the oxidative bleaching methods, reductive bleaching processes are not so effective; a so-called “full white” cannot be achieved in any case. Therefore the reductive bleaching process is just used for the brighten of animalistic fibres or as combination with another bleaching step. Synthetic materials, such as polyacetate and polyacrylic, are treated with reductive bleach. In this textile bleaching method, the reductive bleach reduces the amount of oxygen in the textile. While the opposite of oxidative bleaching, reductive bleach performs the same task. Sodium hydrosulphite is most used as reductive agent of the bleaching process.
OPEN-WIDTH BLEACHING

CONTINUOUS BLEACHING

Most important for the bleaching process are continuous open-width bleaching ranges with best cost-efficiency and highest reproducibility. The process itself takes place in the following steps:

- application of bleaching agent
- steamer with a capacity of for 1-2min tight strand guiding and 10-20min in the Roller-bed section
- washing off

Generally most of the continuous Desizing & Bleaching-ranges are consisting of a prewashing section to remove the cracked size, followed by a wet-on-wet impregnation and steamer, and finally the washing off after bleaching. The exact dosing of the chemicals is essential for the bleaching result. Multiple controls and computerized dosing with sophisticated mixing facilities result in an excellent process capability with best reproducibility and highest quality. Besides peroxide or hypochlorite, the following chemicals are essential for bleaching:

- wetting agent
- complex builder
- stabiliser
- activator & corrosion inhibitor (if using chloride)

Beside the concentration of the liquor, another danger of the bleaching process is the so-called catalyst damage. In this case metal ions (rust, mineral dust at spinning, etc) react with the peroxide in the fibre and lead to extreme damage of the fabric. To prevent catalyst damage, a demineralisation step with oxalic acid or complexing agent is necessary.
INNOBLEACH series product info

**DESIGN CONFIGURATIONS**

**INNOBLEACH-1**: Continuous Bleaching Range running two superimposed ends

**INNOBLEACH-2**: Continuous Singeing and Bleaching Range for yarn dyed shirting fabrics

**INNOBLEACH-3**: Continuous Bleaching Range running two superimposed ends

**INNOBLEACH-4**: Continuous Bleaching Range

**INNOBLEACH-5**: Continuous Singeing, Desizing and Bleaching Range in single operation
THE APPLICATOR

After the fabric is squeezed by the final squeezing unit INNOSQUEEZE-HE-S-222.50 respective INNOSQUEEZE-HE-S-222.56 with S-ROLL, the cotton fabric leaves the squeezer with a residual moisture of approx. 65%. After that, the 1-step continuous bleaching process begins with an equal and reproducible application of chemicals. The INNOMAX wet-on-wet liquor applicator faces this kind of flexible and controlled application of chemicals exceptionally. The applicator consists of two troughs with a very little liquor content of about just 20l together at ww 1800mm. The perfect chemical application with high liquor pick-up leads to an excellent liquor exchange and fast bath renewal with two dipping troughs for an even chemical application and additionally allows a fast change for recipe variations.

After the fabric is impregnated by passing the first dipping trough, the surplus liquor on the surface of the fabric is pressed into the inner of the fabric to intensify the natural impregnation by means of a rubber coated jockey roller. After that the fabric is transferred via a pulling roller to the second dipping trough, where the procedure is repeated. Before leaving the unit, 2 doctor blades stripp off the surplus liquor from the surface of the fabric in case of need. With an aboriginal fabric moisture of approx. 65% and an additional pick-up of bleach liquor of 70-80%, the total liquor amount on the fabric is approx. 140%. This is the ideal amount for the 1-step wet-on-wet bleaching process of woven fabrics.
## TECHNICAL DATA

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<tr>
<td>no. of feeding troughs</td>
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AUTOMATIC DOSING SYSTEM

The combination of short liquor volumes in the trough and the liquor feeding of chemicals allows a change in between less than one minute. The chemical station INNODOS consists, for each chemical component, of one frequency controlled feeding pump, one inductive flowmeter and one control valve, so that a reproducibility of the chemical metering figures is guaranteed. The whole dosing system is self-controlling, which means, if more water is brought in with the fabric then the addition of water – controlled on level – will be reduced. One proportional level control in each liquor trough of the applicator controls the liquor feeding. Based on the effective flow of water, the production and the inputted recipe, the automatic dosing station INNODOS defines the dosing of each single component. The accurate dosing for each chemical is achieved by a frequency controlled pump and a inductive flowmeter. Each single component is pumped into a static mixing tank and is then guided to the liquor troughs of the applicator. Up to 6 single chemicals and water can be dosed. In generally, these are the components peroxide, NaOH, wetting agent, stabiliser and comlex builder.
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<td>no. of control valve</td>
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INNODOS 5+1 AUTOMATIC DOSING SYSTEM
THE STEAMER

In the treatment step of steaming the characters of the fabric are defined. Therefore, the processes circumstances as well as also the fabric guiding are most important. Based on its positive experiences concerning 1-step wet-on-wet bleaching process, DHALL GROUP has engineered a new generation of combi steamer. An equal penetration of the bleaching liquor all over the whole fabric width is guaranteed by the high efficiency squeezing unit INNOSQUEEZE-HE-S-222.50 respective INNOSQUEEZE-HE-S-222.56 with S-ROLL in combination with the wet-on-wet applicator INNOMAX.

After that the fabric is transferred to the inlet section of the steamer, which consists of a horizontal, tight-strand fabric guiding with a fabric content of approx. 27m. This special heated horizontal section ensures a guaranteed even penetration of the bleaching liquor into the inner of the fabric before going into vertical fabric guiding. The vertical tight-strand section is available as single loop or double loop execution and can be chosen concerning fabric weight and production speed of the bleaching-range. An average kind of fabric needs approx. 45s to achieve the necessary temperature. After the fabric is heatend up and swollen, the risk of getting crease marks does not exist any longer, so that the fabric can now be plaited on the roller bed section.
STEAMING STATION

One of the precondition to achieve a good bleaching result is the fact, that the steam inside the steamer has to be saturated and 100% free from air. If not, the steam will take the necessary moisture from the plaited fabric on the roller bed inside the steamer which will result to cross marks on the fabric. Due to this and due to the fact, that steam turbulences can also lead to cloth run troubles, DHALL GROUP uses an external steam conditioning station wherein steam is saturated with water to create an optimal mixture (at 98-102°C). The steam is feeded by means of injection through a regulating valve.

MORE FEATURES OF THE STEAMER

- complete absorption of the bleaching liquor
- equal liquor application
- dripping and stripes are avoided
- frequency controlled A/C drives for less tension
- side walls in re-inforced execution of 6mm
- all bearings are external
- heated steamer roof to avoid drop creation
- guide roller diameter of 203mm
- external steam saturator for 100% even and airless steam
- steam consumption just 450kg/h
## TECHNICAL DATA

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![INNOBLEACH-DL-IV Steamer](image1)

![INNOBLEACH-DL-III Steamer](image2)

![INNOBLEACH-DL-II Steamer](image3)

![INNOBLEACH-DL-I Steamer](image4)
WASHING AFTER PRETREATMENT

WASHING AFTER DESIZING

After the fabric has been desized and dwelled for 4-6h on a rotating A-frame in case of enzymatic cold Pad-Batch desizing process, the cracked size has to be washed off. This can be realized on the pre-washing section of the continuous Bleaching-range or on any other washing-range of sufficient performance. The washing off is most important, because residual size can cause multiple problems like patches, reserved parts on the fabric, lighter shades, moiré, creases, poor absorbency or insufficient degree of whiteness. For washing after desizing DHALL GROUP favors a concept consisting of INNOWASH up & down washing units. To achieve a sufficient wash effect, at least 50m fabric content should be available in the pre-washing zone, which is conform to 2-3 up & down washers type INNOWASH either with single or with double loop execution. An additional vacuum unit type INNOVAC in front of the pre-washing section can already take away up to 70% of the cracked size before entering the washing section. But generally 2-3 wash boxes type INNOWASH at 95°C are sufficient to take care in removing the residual enzymatic size from the fabric as well as also water soluble sizes.

WASHING AFTER SCOURING/BLEACHING

After Scouring/Bleaching the fabric has be washed and the rest amount of NaOH has to be washed off to a certain concentration. The whole washing process should be realized at constant temperatures of 95°C and with a sufficient quantity of wash boxes. For that purpose DHALL recommends to apply the INNOWASH up & down washing unit either with single or to increase the washing effect, with double loop execution. To leave the washing-range with a neutral pH degree of 6-7, it is necessary to neutralize the fabric with acid at the outlet of the washing-range. Otherwise a hard grip of the fabric or a yellowing on the following cylinder dryer may take place. In the last bath, the temperature for rinsing after neutralizing should not be more than 60°C. In other respects, the risk of break down of the acid is increasing drastic.
WASHING AFTER PRETREATMENT

THE WASHING UNITS

Flagship of the INNOWASH washing compartment family is the INNOWASH-DL32-JR5 washing box: This washing unit is fitted with double loop cloth guiding and rubber covered jockey rollers and has a huge cloth content of 32m. This kind of washing box is especially recommended for middle heavy and heavy woven fabrics. All upper guiding rollers are driven individually by means of controlled A/C motors. To prevent any creasings in the fabric run the guide rollers have big diameters of 203/150mm and a driven spiral expander roller is located in the middle of the upper guiding roll raw. In each washing section the fabric is immersed twice into the liquor. At the fabric return point of each underliquor roller the wash liquor forcibly is pressed trough the fabric which results into a perfect liquor exchange between contaminated liquor in the fabric and the fresh wash liquor. The intensive liquor exchange in the fabric is supported by the liquor film which is running back down along the fabric after pressed by the jockey roller. The side walls of all INNOWASH washing units are reinforced and made out of two stainless steel sheets each measuring 3mm in wall thickness. These sheets are affixed to each other by means of dot welding process. This kind of construction assures absolute stability of the whole compartment, absolute true running accuracy of the guiding rollers and a good heat insulation against loss of heat. INNOWASH washing compartment are available in various executions and with various cloth contents: double or single loop execution, with or without jockey rollers, with or without separate A/C motors for the upper guide rollers and with fabric contents up to 32m.
THE DRIVE SYSTEM

All DHALL ranges are characterised by particularly comfortable plant control and drive technology. All main drives are implemented as frequency controlled A/C-gear motors. As far as mechanical conditions permit they work as direct drives without mechanical intermediate drives. The air-conditioned switch cabinet accommodates the electrical control units for all drives of the complete range. Likewise, the central control panel is equipped with an air-conditioning system. The central operating interface of the control panel can either be operated as a touch-screen or via mouse. Imported attributes such as presetting of fabric tension, quantity of water, chemical quantity defaults etc., can be made. A modem for remote service and maintenance of the range is certainly a standard feature. Frequency controllers can be offered standard from LENZE, ABB & SIEMENS and other systems.

FREE FROM WRINKLES & CREASES

Large diameters for all guiding rollers of 203mm prevent a formation of wrinkles and lateral displacement of the fabric. This is supported by computer controlled fabric tension, easy running external bearings with low frictional resistance; frequency controlled spiral spreader rollers as well as short distances between the guiding rollers. Load cells with a very sensitive tension range as well as pendulum and turning compensators guarantee a passage free from creases and wrinkles.
EXAMPLES OF INSTALLATIONS

The classical plant examples specified here are to give a short overview of the application range of the INNOBLEACH range. The intelligent modular unit assembly system permits most differential range combinations.

INNOBLEACH-1: Continuous Bleaching Range running two superimposed ends

INNOBLEACH-2: Continuous Singeing and Bleaching Range in single operation for yarn dyed shirting fabrics

INNOBLEACH-3: Continuous Bleaching Range running two superimposed ends

INNOBLEACH-4: Continuous Bleaching Range

INNOBLEACH-5: Continuous Singeing, Desizing and Bleaching Range in single operation