



RBNO-I

HORIZONTAL DYEING SYSTEM



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The patented RBNO horizontal yarn dyeing machine has been shown as an advanced prototype during ITMA 83 International Exhibition.

The **European Patent** No. 89.109.914.0 was obtained in December 1984, followed by Patent Rights in all main developed countries.

RBNO is an international best seller for yarn package dyeing, with **over 700 machines** installed worldwide, covering all the sectors of textile industry.

In 1985 RBNO was the base of the **world first fully robotized yarn package dye-house**.

The large number of fully and partly robotized plants in operation confirms the outstanding performance of the system. RBNO has been continually developed and innovated along these years and now the **RBNO-I version is the only one available in the market with 3 different diameters in a various possibility of length, therefore with a wide range of capacity, from 35kg to 2500 kg (in case of Polyester, coupled machines ; 1000 kg for cellulosic fibre, coupled machines).**



INNOVATIONS

The new machine has been redesigned to follow the market needs. Production range widening, consumptions reduction and loading flexibility drove the design of the new model

- **NEW HORIZONTAL SMALL BATCHES MACHINE**

Together with its "old" sisters RBNO-I 1800 and RBNO-I 1400, a RBNO-I 840 is now available to cover a production range of 35 to 200 kg

- **VARIABLE LOADING BY MEANS OF LIQUOR LEVEL LOWERING**

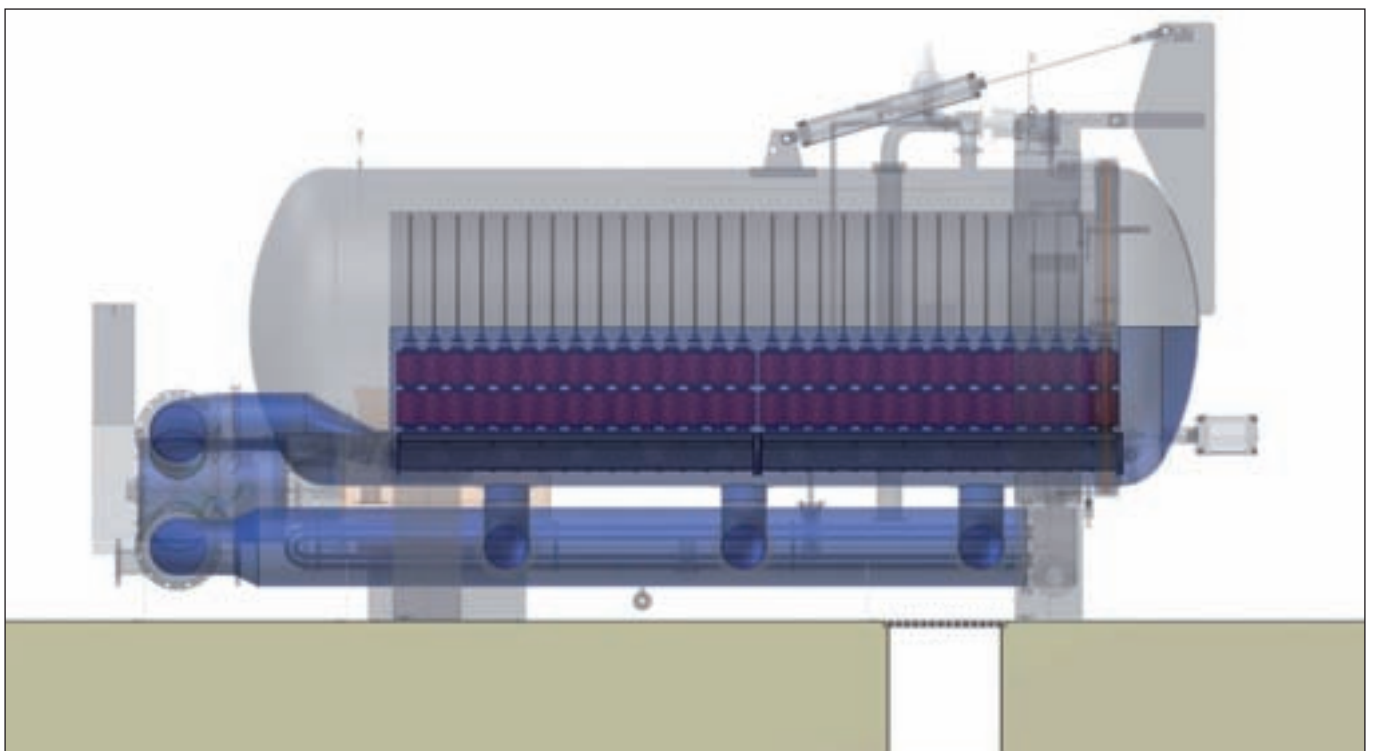
As our vertical model RBNV-I, no more need of dummy boxes to dye variable loading. Thanks to a new hydraulic circuit design, the variable loading is realized simply lowering the liquor level

- **PULSE RINSING SYSTEM NOW AVAILABLE ON HORIZONTAL MACHINE**

The new hydraulic circuit now allows the use of the much appreciated water saving Pulse Rinsing[®] already implemented since 10 years now, on our RBNV-I vertical version

The innovated RBNO-I models represent the solution that meets the industry trends, in terms of Operational Costs Reduction, flexibility, production range capacity, versatility.

Over the years everyday more spinning mills decided to add value to their yarn. RBNO-I is the best partner in this new adventure. An easy operating, floor installation, fully automatic, variable loading, modular dye-house is available thanks to RBNO-I horizontal yarn dyeing machine.



AIR PAD PRESSURIZATION

RBNO-I as all Loris Bellini dyeing machines, since the beginning of the 50's, is Air Padded. RBNO-I dyeing machine can be rapidly pressurized at 5 Bar at low liquor temperature.

ECOLOGY AND ENVIRONMENT:

- **LOWER CONSUMPTION**

Only pump and carrier volumes are flooded, with **reduction of liquor ratio** to a minimum water, steam and power consumption. Substantial savings are realized in term of cooling water (no cooling of liquor before expansion tank), steam (no reheating of liquor back to dyeing temperature) and electric power.

- **LOW EMISSIONS**

The air pad operates as a double chamber to reduce heat emissions in the dye-house. **NO external Expansion Tank** means no emission of chemical vapours.

DYEING TECHNOLOGY

NO external Expansion Tank means no continuous external circulation, thus liquor expansion volume realized directly into the autoclave

- Dyestuff exhaustion is perfectly equalized
- Air pad pressurization allows to inject dyestuffs and chemicals directly into the main liquor circuit by means of single tank or a multi tanks color-kitchen. Dyestuffs are injected into the highest turbulence point of liquor circulation pump, in order to originate an intensive stirring effect.
- **VAT DYEING**
During cotton dyeing with VAT dyestuffs the dyeing liquor is not subject to a continuous oxidation by external air.
 - Sodium hydrosulphite is just added right at the start in limited stoichio-metric quantity.
 - No continuous additions during dyeing cycle to compensate external oxidation in expansion tank.
 - No intermediate checking of reduction level is needed.
- Dyeing liquor temperature remains perfectly steady at set value, due to absence of continuous liquor cooling/ reheating
- Air Pad Pressurization allows the machine to be **standard** equipped with dynamic **by compressed air HYDRO-EXTRACTION DEVICE**:
 - Elimination of unfixed dyestuff so increasing colour fastness
 - Preliminary water squeezing which avoids carrier dropping and helps the centrifuging operation

GROUND-FLOOR INSTALLATION

The complete RBNO-I system (dyeing machines, dryers, handling equipment) is installed at floor level.

Dyeing carriers are loaded and unloaded horizontally and are transported at ground level by a rail-mounted shuttle system or wheeled trolleys.

- No Crane, and all the relevant infrastructure, needed
- Elimination of underground civil works



SINGULAR OR MODULAR CARRIERS LAYOUT FOR FLEXIBILITY AND QUICK RESPONSE

The new RBNO-I machine, not needing dummy boxes to work at variable load, can be both flexible and economical, even using **one single piece dedicated carrier**.

When the modularity of the dye-lots has to meet the need or the will to interchange the carriers in different capacity machines, **the modular carrier layout is the solution**.

In this case a base carrier is defined and it'll be the only "protagonist" of the dye-house. The machine will work with modular interchangeable carriers, in the number of one, two or three carriers in series.

The new RBNO-I is designed as the old model RBNO to guarantee the same dyeing liquor- ratio among different number of carriers machines.

Here following a table shows the enormous loading capacity range now available with RBNO-I model

AVERAGE LOADING CAPACITY FOR 1,8 Kg COTTON PACKAGES					
Model	RBNO-I	machine Length (mm)			
	840	1000	1500	2000	3000
	1400	130-210	180-300	260-430	370-620
	1800	200-340	285-500	360-640	580-1000

CONSTANT LIQUOR RATIO WHEN DYEING SMALL TO VERY LARGE PACKAGES

The latest industry trends require the highest flexibility in package sizes and weight. RBNO-I already meets the challenge.

Interchangeable dyeing carriers allow to optimally dye at practically constant liquor ratio, yarn packages /Tops, ranging in diameter from 110 to 400 mm. During the last 10 years, the outside diameters of average cotton packages increased from 165 to 180. Because of Loris Bellini Pump, it is more than 20 years we are working with 215 mm diameter packages for cotton reactive dyeing, and 245 in acrylic.

The incomparable capability to optimize the space, on high-density packages, such as Automotive Polyester ones, allows to get down to 3,5:1 liquor ratio.

Constant liquor ratio, means:

- No need to change recipe
- Maximum grade of repeatability
- Process costs standardization

This will guarantee to meet the nowadays market needs of Just-InTime and maximum flexibility.





LIQUOR CIRCULATION SYSTEM

The most important reason of such a world wide success: an exclusive, innovative, dedicated pump and liquor circulation system engineered for:

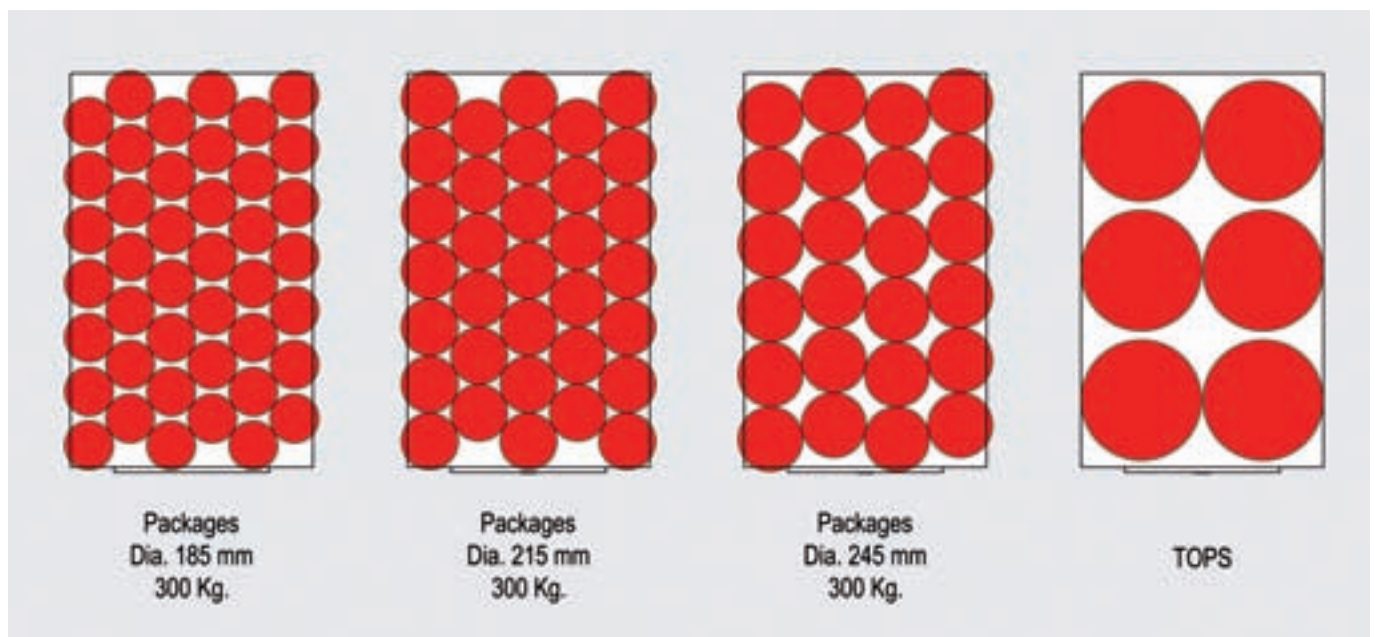
- **Liquor volume Reduction**
- **Liquor turbulence Minimization**
- **Evenness of liquor distribution on all carrier areas**
- **Complete access to all components for an easy inspection and maintenance.**

The hydraulic circuit is completely free from bottlenecks or restrictions which determine in conventional autoclaves a head pressure loss, turbulence and noise.

The internal chamber operates as heat insulation.

The optimized hydraulic circuit allows from 3 to 6 complete change of the whole liquor per minute in accordance to type of material and pump's speed, for excellent dyeing evenness even in the most critical dyeing conditions for rapid dyeing of:

- Large cotton yarn packages (ex. 1800gr. weight, 215mm. outside diameter, 6' traverse).
- Big Acrylic yarn packages and blends (ex. 2000 to 3000 gr. weight, 245 to 280 mm. outside diameter, 6' traverse) in 50-70 minutes.
- Large air and mechanic textured polyester filament yarns (ex. 3500 to 4300 gr. weight, 215 to 250 mm. outside diameter, 10' traverse).



HELICOCENTRIFUGAL PUMP

The heart of RBNO-I dyeing machine is the inimitable **HELICOCENTRIFUGAL** type liquor circulation pump, which is a mixed design between an axial and a centrifugal impeller, specifically designed to cover the complete range of differential pressures (**Delta P**) from 0.2 up to 2.5 Bar.

In fact, nowadays, dyeing mills have to be able to process a huge variety of fibers and yarns, from high permeability as acrylic and wool (0.2 to 0.8 Bar) up to low permeability as cotton, viscose and cuproammonia rayon (0.8 to 1.5 Bar), or the super dense Polyester packages (up to 2.0 Bar), in the same dyeing machines at the best conditions. Shaft of motor always rotates in a single direction. Motor does not stop during flow reversal.

Automatic reversal of liquor flow direction is performed at preset time intervals by means of a special **Flow Reversal Device (RD)** integrated into the pump and consisting of a rotating elbow which slides sideways the delivery mouthpiece from inside-out (I-O) to outside-in (O-I) direction and vice versa.

Precision positioning of reversal curve is originated by a combined pneumatic-oleodynamic system (PC), in order to perform a very smooth liquor flow reversal without hammering effects.

The final result is an outstanding dyeing evenness, even in critical dyeing conditions.

Liquor flow reversal is made with motor in operation in order to **avoid peak power absorption** due to delta-star motor restarting.

The circulation pump is equipped with **cooling-free and maintenance-free mechanical seals.**

The helicocentrifugal pump with built-in liquor reversal system allows an hydraulic circuit of compact overall dimensions, with all components laid out in function of easy inspection and maintenance. **The helicocentrifugal pump has been entirely engineered by Loris Bellini**, and each one is tested on our own computer controlled pump testing centre.

As all parts, where an inspection could be foreseen, the pump is connected to the kier by two parallel piping, **by means of flanges** for easy installation, and to allow future installation of flow meter device (optional)



THE OPTIMIZED DYEING

As all new generation Loris Bellini yarn dyeing machine RBNO-I is equipped with:

- **INVERTER** for step-less pump speed control, which operates pump speed with accuracy of 1 PM and saves up to 40% of electric power consumption on high permeability yarns. Pump speed is controlled automatically for both Inside-Outside and Outside-Inside directions.
- **ADPS**. An automatic differential pressure control system. Which monitors and controls differential pressures Inside-Out and Outside-In of material and adjusts automatically the pump operating speed to maintain the preset value of differential pressure. **ADPS** was pioneered several years ago and still remains the best control system for color repeatability in package dyeing. After optimum values of differential pressures for a specific yarn package are memorized into the controller of the dyeing machine, the ADPS system automatically regulates the liquor flow rate by acting directly on pump speed, in order to operate in the dyeing process under constant parameters for color reproduction. **ADPS** sets values differentiated in terms of flow direction, operating phase (ex: high flow rate at critical dye exhaust temperature, low flow rate during bleaching) and yarn package type in analogical form and regardless of other conditions (temperature, static pressure, etc.) which are controlled independently. **ADPS** also operates as a safety

system: in case of a leakage from a locking cap it increases automatically the pump speed by acting directly on the Inverter to compensate the loss. It also provides on-line automatic control on pump speed and reversal device.

- Signalling and alarm of **ERRONEOUS DIFFERENTIAL PRESSURE VALUES**.
- Signalling and alarm of **CIRCULATION PUMP STOPPED**.

The ADPS system permits to obtain an excellent control of physical dyeing parameters with results of color shade repeatability, flexibility regardless of loading rate and densities, rapid dyeing, reduction of power consumption.

Optional

- **MAGNETIC FLOWMETER:** normally for Polyester and worsted Wool tops plant, the pump can be driven by a real-time flow rate monitoring and control. This closed-loop system permits to set a In-Lab predetermined Flow Rate Value, and keep it constant despite the Delta P variation due to the change of the fibre permeability during the process. The liquor flow rate regulation system allows to adopt the best dyeing conditions in function of the material under process (yarn, tops, tow, loose, stock), type of fiber (cotton, polyester, wool, etc.) dyestuffs classes, material density and permeability.

COTTON	PES	LINEN	PES	PES	SILK
	Text Small Count	Sliver Cop	20 Den Monof.	Text Big Count	Monof.
1.8 kg	3.6 kg	1 kg	2 kg	4,3 kg	750 gr



MACHINE PROCESS MANAGEMENT

"Leonardo" Industrial PC machine controller.

RBNO-I dyeing machines can be supplied with Leonardo PC computers designed to be optionally interfaced to a central host computer station for dyehouse management.

Leonardo operates on industrial PC with features of:

- Reliability in dye-house operating conditions up to 50°C room temperature.
- Touch Screen interface for easy programming
- "Multitasking" operation.
- Presetting for network connection with external computer for centralize dye-house management
- Machine configuration simply by software.
- Automatic fault finding system
 - temperature outside range
 - lack of compressed air,
 - exclusion of safety systems
 - failure of motors and main valves
 - failure of level and temperature probes with display of cause of fault for immediate identification and maintenance.
- tank closing lid
- automatic **CONTINUOS** liquor level controls
- **Transfer/Mixing Pump**, with connection piping, recirculation piping for mixing operation and automatic cut-off valves
- liquor drain valve (s)
- tank washing system by large perforated coil
- connection piping with the Colour kitchen tanks
 The preparation/recovery tank allows to eliminate downtimes of the dyeing machine, feeding it with a precise quantity of liquor at preset temperature, with dyes and chemicals perfectly mixed.
 It is an absolute must for cellulosic based yarn.
- **Automatic coupling system**
 The system operates by total liquor exchange with the following features:
 - cross flow exchange piping
 - Liquor level equalization, (**exclusive in Loris Bellini**), by means of a water level equilibration tube linking the two kiers and a static air pressure levelling tube linking the two air pads
 - master/slave control panel and microprocessor operation. Coupled machines can operate single (two separate colour shades) or coupled (same shade).

OPTIONS

RBNO-I is a full all-round system. Dyeing machines can be supplied on request with a wide range of optional such as:

- **HT Draining Device**, which enables to drain liquor at 130°C for total Oligomer elimination during Polyester dyeing process. It operates on the individual machine, **without underground works**. It consists of: one stainless steel liquor blending vessel, one automatic water drain valve, one temperature probe and relevant control equipment, one modulating proportional automatic cold water inlet valve and connection device.
- **Exponential/Linear Alkali Dosing system Mod DL. EXCLUSIVE Loris Bellini system** which permits the alkali (but also dyestuff or auxiliaries) introduction without changing the liquor ratio, perfectly following the designed introduction Volume/Time Curve. It consist of:
 - continuous levels in dye kitchen tanks, automatic liquor recycle valves
 - dedicated software for RBNO-I microprocessor
- **Automatic liquor preparation recovery tank.**
 Liquor preparation/recovery tank is designed to contain over 100% of machine liquor volume. It is equipped with automatic water filling valve (s)
- **FLANGED** indirect steam heating coils with modulating proportional valve.

RBNO-I FEATURES:

- **Standard design and manufacturing features:**
- **Machine loading capacities from 25 to 1250 kgs. (2500 kg cupled)**
- **Dynamic Hydro extraction Device.**
- **Pressure rating of 5.0 kg/cm2, up to 160°C temperature.**
- **Construction in AISI 316 stainless steel, for all the part in contact with dyeing liquor.**
- **Water protected motors (IEC Standards IP54).**
- **Three-level safety systems.**
- **Magneto-thermal motor protections.**
- **Heat exchangers rated for 15.0 kg/cm2 operating pressure.**
- **Heating gradient 5°C./minute (range 20-80°C steam pressure 6.0 kg/cm2) Cooling gradient 3°C./minute (range 130-108°C water temp. 15°C, pressure 1.5 kg/cm2).**
- **Rapid lid locking system.**



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