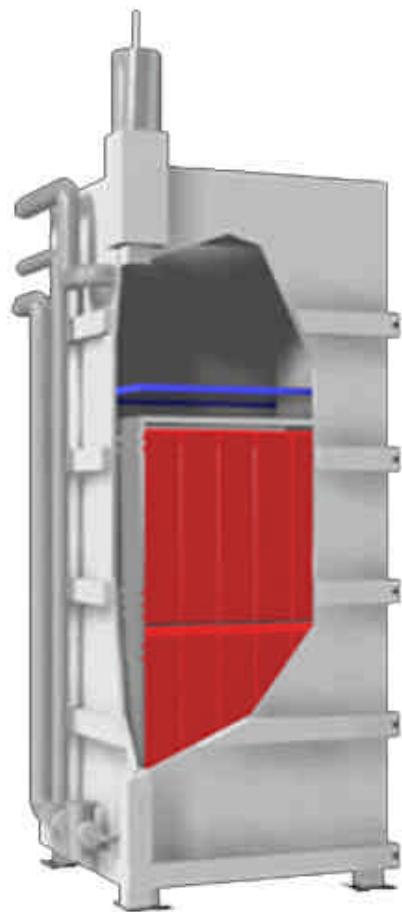


APPC - LV



**PRESSURE DYEING CABINET
FOR HANKS**



Dyeing machines

PRESSURE DYEING CABINET FOR HANKS

The APPC-LV cabinets have set new standards in flexibility, reliability and automation.

Backed by more than 40 years of engineering and manufacturing experience and over 3000 cabinets in operation worldwide, the LV Series have been developed with the assistance of several professional users.

FLEXIBILITY

- **Variable loading system at constant liquor ratio**
- **Fully interchangeable loaders for hanks of different reeling diameters**
- **Continuous liquor flow rate regulation system by Inverter.**

APPC-LV pressure cabinets use fully interchangeable loaders for dyeing hanks of different lengths **in the same machine.**

A-"HB" HANK LOADERS.

Woollen and worsted knitting yarns made for instance of:

- 100% Acrylic High-Bulk
- 100% Wool, worsted and woollen yarns and Acrylic blends
- Wool/Nylon blends
- Cashmere, angora and blends
- Cotton/Acrylic and Viscose/Acrylic blends.

APPC-LV can indifferently use loaders types HB 860 and HB 970. Liquor filling is automatically adjusted to cover the yarns completely, regardless of loader height.

B-"COT" HANK LOADERS FOR MERCERIZED COTTON

Mercerized cotton yarn hanks for high-quality knitted goods, mens socks, hosiery, crochet yarns, sewing threads. APPC is available in two versions COT 700 reeling 54" and COT 1200 reeling 90".

C-DRAWERS FOR PANTYHOSE

Static dyeing of tights, pantyhose and stockings in nylon and nylon-Lycra(TM DuPont). Variable loading in height.



Large automated dyehouse for worsted knitting yarns on hanks.
No.22 pressurized cabinets APPC-LV linked to central host computer.
Centralized heat recovery system and water recycle by reverse osmosis.
VLS variable loading system.

AUTOMATIC AIR-PAD PRESSURIZATION

APPC-LV cabinets operate at 0.4 bar static pressure up to 110°C temperature. Static pressure is obtained by a compressed air pad in the zone above the dyeing liquor.

The air-pressure zone acts as expansion chamber for the increase of liquor volume during temperature rise or additions of dyes and chemicals and occupies approx. 25% of internal volume.

Static pressure is automatically controlled by air inlet and pressure regulation/release valves.

Air-pad pressurizing has a large number of practical plus-points:

A. EXPANSION VOLUME INSIDE THE CABINET.

No continuous external recycling to an external expansion tank, typical of a traditional dyeing cabinet.

Steady temperature due to absence of continuous heating/cooling.

Dye add tank or color kitchen installed in the best convenient area within 70 meters from machine. The entire volume of liquor participates to dyeing process with a constant and controlled dyestuffs exhaustion rate.

B. LOW WATER-STEAM-POWER CONSUMPTION.

No high power consumptions due to static pump in continuous operation. Reduction of liquor ratio due to elimination of pipings: the only flooded volumes are hank loader, pump and rear channel.

Low heat dispersion due to air pad operating as insulation.

No cooling water consumption to cool dyeing liquor below boil in expansion tank, no steam consumed for reheating the liquor back to dyeing temperature.

C. SAFE DYEHOUSE ENVIRONMENT.

Absence of chemical vapours in dyehouse environment.

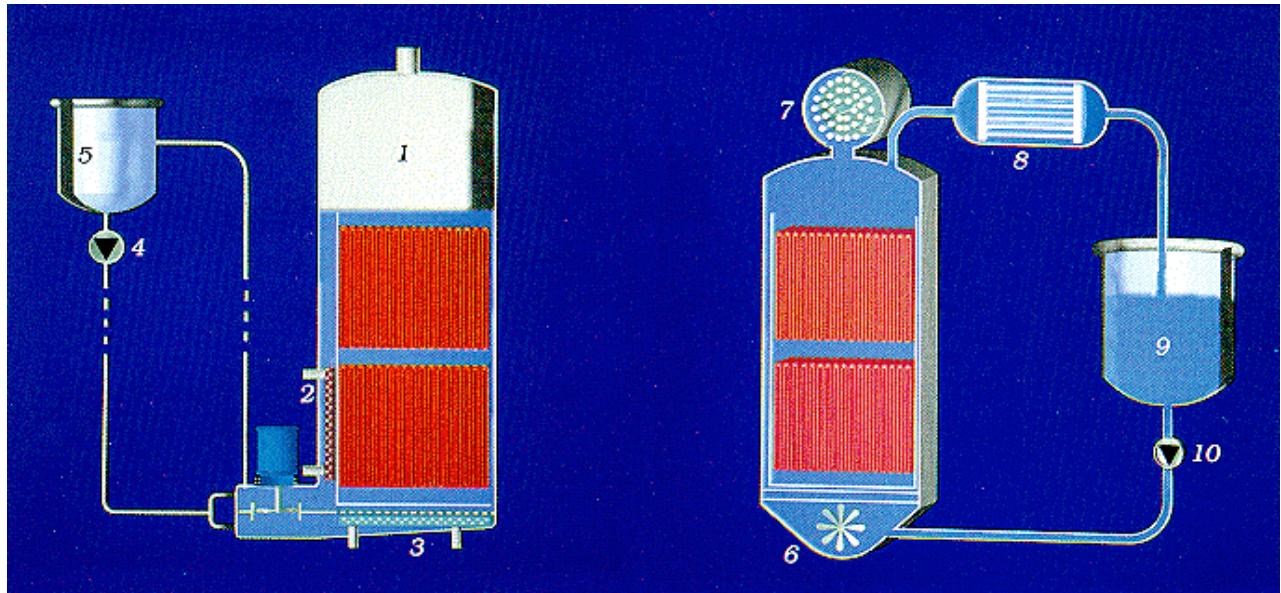
During vat (Indanthren) dyeing sodium hydrosulphite is added in stoichiometric quantities to reduce both air and dyestuffs to leuco, with no further addition during dyeing cycle.

D. DYES AND CHEMICALS DIRECT INJECTION.

The high-pressure injection pump inserts dyes in the highest liquor velocity point of circulation pump and not by uncontrolled dilution in a lateral expansion tank.

E.- PERFORMANCE.

APPC-LV cabinet can be pressurized instantly at cold liquor conditions. Liquor drain velocity is increased by the controlled force of air pad pressure. Rapid drain by air pad reduces drain times to 1/3 as compared with gravity. Contacts dyestuffs/fibre increase at constant liquor speed due to lower liquor ratio.



APPC-LV cabinet

- 1-Air pad pressurization
- 2-Independent heating exchanger
- 3-Independent cooling exchanger
- 4-External reversible axial pump
- 5-Automatic add tank or kitchen

Traditional cabinet

- 6-Internal axial pump
- 7-Heat exchanger
- 8-Continuous liquor cooling
- 9-Lateral expansion tank
- 10-Static mixer in continuous operation

LIQUOR RATIO CONTROL SYSTEM

The main advantage of APPC-LV pressurization system is that liquor volume and loading rate are automatically controlled.

Machine filling is done by continuous automatic level probes or electronic liter-counter.

The dyer can operate the machine with the best-suited liquor ratio.

Liquor ratio parameter is perfectly repeatable batch-to-batch and controlled based on dyestuffs solubility and process phase.

A-LOW DYEING LIQUOR RATIO.

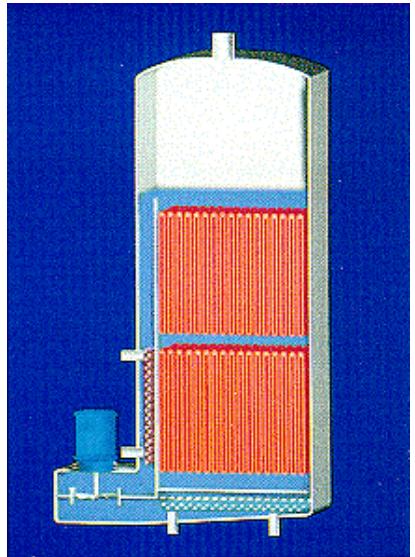
Dyeing liquor ratio 9-10:1 for mercerized cotton and 12-14:1 for acrylics.

Material is completely immersed in dyeing liquor with bidirectional flow.

Low liquor ratio saves large dyeing costs in process water, steam and all chemicals added at fixed concentrations based on liquor volume.

Perfect dyeing evenness due to increased contacts dyestuffs/fibre at low liquor velocity.

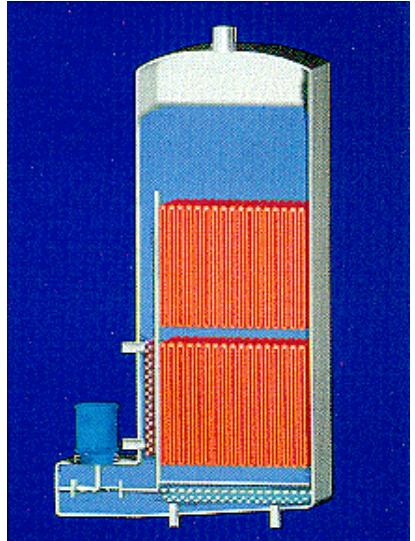
High-speed hank-to-cone winding due to absence of yarn entanglements and felting. Lower dyeing costs spell faster return on investment.



B-HIGHER LIQUOR RATIO DURING WASHOFF.

During wash-off phase after dyeing the higher liquor ratio reduces overall water consumption due to higher solubility and rapid removal of unfixed dyestuffs and chemicals.

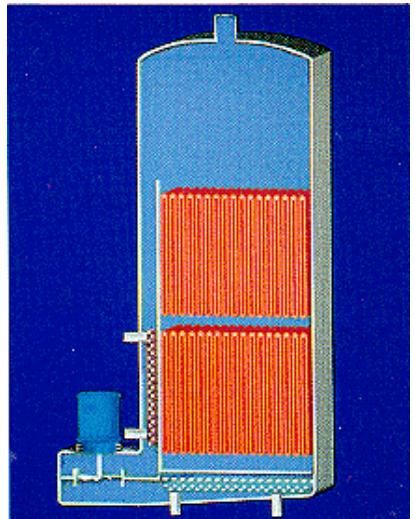
After reactive dyeing of cellulosic fibres, the liquor ratio can be raised to 1:13 approx.



C-MAXIMUM LIQUOR RATIO DURING OVERFLOW RINSE.

Clean rinse water is fed from the bottom of machine and after filling the dyeing chamber it is drained by a separate overflow let-off valve.

Overflow rinse can be controlled and reproduced either by time or volume by automatic liter-counter.



Continuous level controls on APPC-LV enable to equalize the liquor ratio between machines of different sizes in order to maintain constant the standard dyeing recipes regardless of machine capacity.

On APPC-LV the reduction of liquor ratio it is realized, besides air pad pressurization, by CAD-CAM engineering and manufacturing:

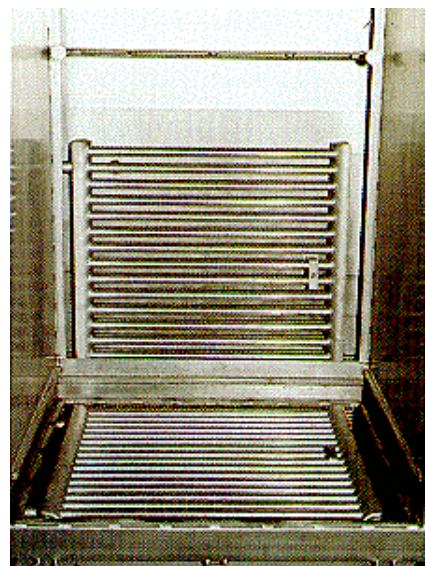
- **Separate heating and cooling heat exchangers inside each chamber**
- **Stainless steel plate thickness of 6 mm.** to allow highest manufacturing accuracy and elimination of gaps between loader and dyeing chamber.
- **Total elimination of external pipings** by use of rear wall of loader and rear wall of chamber for full-width liquor circulation.

Rugged construction allows for 24-hour/day continuous operation in the most critical conditions without deformations.

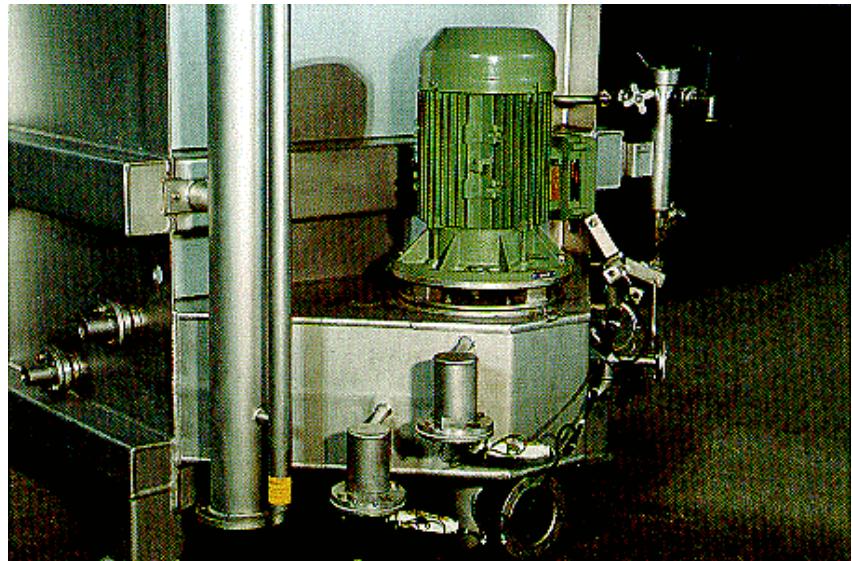
Two-door models are realized by separate chamber structures linked by cross-members for higher rigidity.



Plate thickness six (6) mm.



Two separate heat exchangers in each chamber.



Axial circulation pump controlled by Inverter

VLS VARIABLE LOADING SYSTEM.

The outstanding operating flexibility of APPC-LV is enhanced by use of interchangeable hank loaders for dyeing:

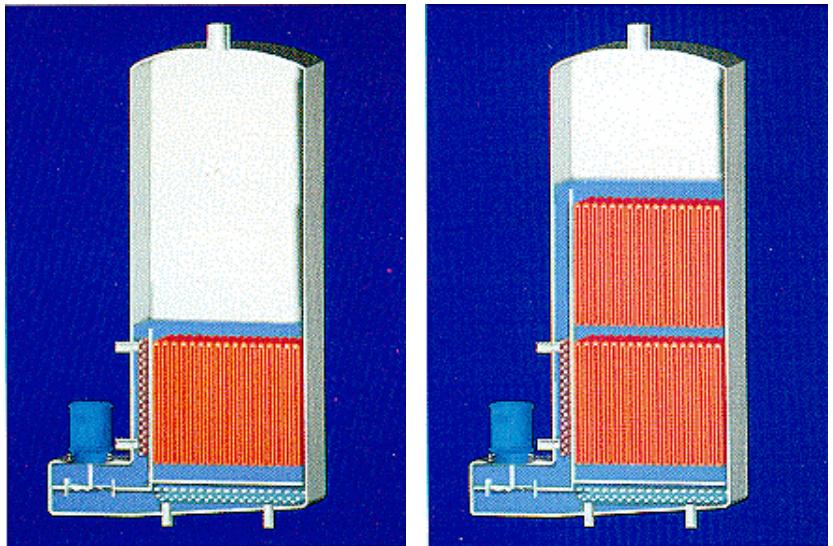
- Hanks of different sizes and reeling circumference.
- Dyeing of half-loads at constant liquor ratio and flow rate/kg

Continuous level controls enable filling of water to flood the yarn hanks regardless of their size.

Interchangeable loaders establish the recycling height by the height of their rear wall.

Liquor circulates between rear wall of loader and rear wall of chamber.

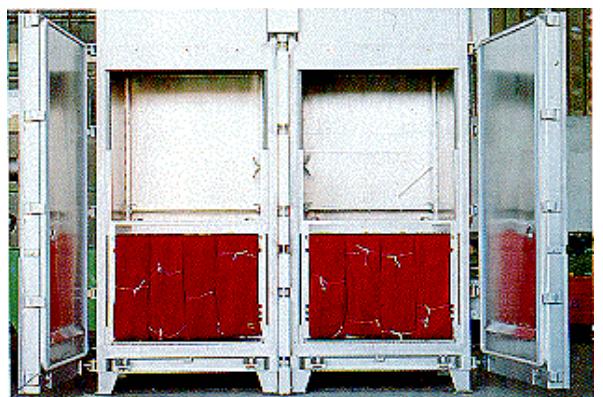
Liquor circulation pump is controlled at stepless speed by **Inverter** (AC power frequency converter) to obtain a constant value of liters/kg/minute.



VLS Variable Loading System at constant liquor ratio.



APPC-LV operates at full or half load just by using 1-tier or 2-tier hank loaders.



Operation at half load



Operation at full load

OPEN LIQUOR CIRCULATION SYSTEM

The hydraulic circuit is designed to prevent turbulence in the dyeing chamber for accurate dyeing of the most delicate yarns without felting and entanglements for high-speed hank-cone rewinding.

Bottlenecks leading to uncontrolled differences in linear liquor velocity have been totally eliminated.

The reversible axial circulation pump is installed outside the dyeing chamber.

Pump is engineered and manufactured by Loris Bellini for **high flow rate at low pressure**.

The connection between pump and dyeing chamber is by **variable section ducts**.

The largest cross-section it is facing the dyeing chamber to distribute the liquor over the full width of the cabinet at suction and delivery.

Furthermore distribution grids and internal heat exchangers maintain the liquor flow perfectly parallel to the direction of the yarn.

Liquor circulation is reversed smoothly at preset time intervals by progressive:

- Running at preset speed (Top to bottom)
- Deceleration
- Stop
- Acceleration in opposite direction
- Running at preset speed (Bottom to Top)

Gradients are automatically set by Inverter.

Speed accuracy is extreme: Plus/Minus 1 RPM.

Impeller is designed and built by Loris Bellini for installation on dyeing cabinets.

Since an integrated hank dyeing plant normally consists of machines of different capacities, the flow rate and head pressure values are set and tested for constancy, so as to ensure **color shade repeatability between dyelots**.

FLOOR INSTALLATION

APPC-LV is installed at floor level without foundations.

Defects typical of cabinets with underground pumps fitted on a long shaft (vibrations and mechanical seals wear, difficult access for maintenance, extreme loader height and difficult hank loading) have been totally overcome.

APPC-LV does not require underground excavations. Hank loading at reeling stage and unloading at drying phase are done at **ergonomical height**.

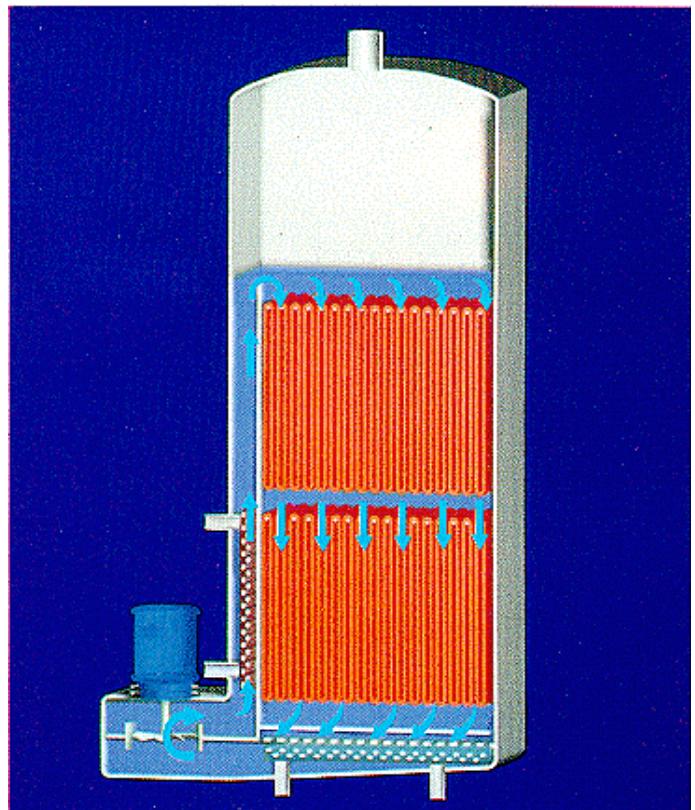
Circulation pump and all components subject to maintenance are **fully accessible from all sides**.

The pump is engineered for rapid online change of mechanical seals in a matter of minutes with no downtime or production losses.

The cabinet overall height is only 3700 mm.

APPC-LV can be rapidly installed in any building with low roof clearance. Due to preassembly before shipment, absence of foundations, and self-enclosed construction the **total savings in installation cost** for a new dyehouse based on APPC-LV pressure cabinets are important. Also times and costs for assembling, connecting and commissioning are reduced

*Open liquor circulation system.
Liquor flows between the rear walls of loader and dyeing chamber on the full width.*



MODULAR CONSTRUCTION

Loris Bellini's APPC-LV pressurized cabinets are available in different capacities and with diversified equipment to meet any requirement. Interchangeable, modular loaders permit dyeing hanks of different lengths.

WOOLLEN AND WORSTED

•HB 860 loader.

For hanks of max. 860 mm suspended length.
Hank length after bulking from 565 to 745 mm.
This loader size is used throughout Europe for dyeing woollen and worsted yarns and mercerized cotton.

•HB 970 loader.

For hanks of 970 mm suspended length.
Hank length after bulking ranging from 610 to 790 mm...
Mostly used in Europe and Far East for dyeing HB and VHB acrylic yarn.

MERCERIZED COTTON

•COT 700 loader.

Standard version for mercerized cotton with 54 reeling circumference.
Hanks suspended length from 520 mm up to 700 mm.
Used by large majority of mercerized cotton dyers worldwide.

•COT 1200 loader.

Special version for mercerized cotton hanks with 90 circumference.
Hank suspended length from 880 mm upto 1200 mm.

Sticks have standard width of 1003 mm., are interchangeable between all machines and suitable to be used on automated continuous squeezing and drying lines.

Loaders transport trolleys are interchangeable for all machines models.

Every component, such as circulation pumps, pneumatic valves, preparation and recovery tanks, color kitchens, etc., is modular, so as to provide an **organized expandable system** and simplify servicing and spare part stock.

HB LOADERS - YARN CAPACITY

Model	HB 860 kg	HB 970 kg
APPC-250	336-380	356-390
APPC-200	288-330	305-330
APPC-125	168-190	178-195
APPC-100	144-165	152-165
APPC-50	72- 82.5	76- 84
APPC-25	36- 41	38- 42
APPC-12	18- 20	19- 21

COT LOADERS - YARN CAPACITY

Model	COT 700 (kg)	COT 1200 (kg)
APPC-230	414-460	352-390
APPC-200	360-400	306-340
APPC-115	207-230	176-195
APPC-100	180-200	153-170

Load capacities are indicative due to high fluctuations generated by yarn count and hank weight.

Loaders Mod. 100-200 and 115-230 are interchangeable.

Models 25-50-100-200 can use stick spacings of 50.4 or 56 mm.

Yarn capacities of all versions and models vary according to the type of yarn to be treated (fibre, count, bulking rate, hank weight and width).

Capacities are given as a guidance only without engagement.

Loaders Mod. 100-200 and 125-250 are interchangeable.

Models 25-50-100-200 can use stick spacings 50.4 - 56 - 63 - 72 - 84 and 100.8 mm centers

RAPID DOOR LOCKING DEVICE

The device automatically closes and locks the doors by means of two pneumatic jacks, an electropneumatic device for sequential operation and operator safety interlocks.

The sequence is:

- A horizontal-acting pneumatic cylinders swings the door closed against its sealing gasket.
- A vertical-acting pneumatic cylinder operates door safety locking.

The rapid locking device:

- Eliminates a tedious work by the operator and cuts door closing/opening times to 1/3.
- Assists high-density loading of bulky hanks of HB acrylics yarns and blends.
- Applies a controlled pressure to door gaskets and prevents accidental damages.

AUTOMATIC PREPARATION/RECOVERY PLANT

The preparation/recovery plant is available upon request.

It automatically operates the entire sequence: water filling, heating, temperature setting, high-speed mixing by transfer pump and bidirectional transfer machine-tank-machine.

It is available in two versions:

- **STANDARD**, with total volume transfer time below 4 minutes.
- **RAPID**, with total volume transfer time below 90 seconds.

Transfer is by an independent, high-flow rate axial pump.

Reversible operation allows for transferring the liquor:

- from dyeing cabinet to the P/R plant to add salts or chemicals, and
- from P/R plant to dyeing cabinet for hot water bulking of HB acrylic yarns.

Liquor preparation is important dyeing mercerized cotton by reactive dyes, which requires frequent transfer operations and liquor preparations which affect total machine performance.

Transfer pump may also be used for FORCED MIXING and RAPID DRAIN of APPC-LV.

Preparation plant enables to reduce peak demand on water and steam feeding lines.



Large hank dyeing plant for knitting yarns with automatic liquor preparation tanks and kitchens.

ACCESSORIES

APPC-LV can be equipped on demand with the following options:

A. Automatic color kitchen.

Air pad pressurization enables to easily centralize an automatic color kitchen with 2 to 6 tanks for multiple products preparation and injection at preset time intervals.

The kitchen may be installed up to 70 meters away from dyeing machine. Installation can be at same floor level or even underground since dye injection is by high-pressure pump.

For mercerized cotton, which is mostly dyed with reactive dyestuffs, the most common version is the 6-tank, so that dyestuffs and chemicals can be immediately prepared at cycle start with no further operators interventions.

Loris Bellini color kitchens are equipped with:

- Automatic filling and flushing valves.
- Automatic injection valves.
- Automatic drain valves.
- Electric stirrers of whirlproof type in AISI 316 stainless steel.
- Automatic air exhaust from the injection circuit.
- Automatic level probes of continuous types for linear/exponential dosing
- High-pressure injection pump (Bellini- designed and manufactured)

• Automatic liquor recycle APPC-kitchen-APPC to add salts and chemicals at constant liquor ratio.

Control board of steel, containing the Pcbased control microprocessors and equipped with warning and signal devices and manual controls.

LP color kitchens can be linked to:

- Bellini automatic powder salt dispenser Model DSC.
- Bellini linear/exponential dyes and alkali dosing system Mod "DLC"
- Computer dispensing of powder dyes and liquid chemicals.

B. PC - based controller.

The "LEONARDO" PC-based controller, besides automatic dyeing machine controls, provides a range of auxiliary functions and services:

- Self-diagnostics (machine and microprocessor)
- Operator safety interlocks
- Utilities (electricity, compressed air, steam) failure alarm
- Operator warnings (signals, cycle stop, alarms)
- Mod. LP color kitchen
- Mod. DSC salt dispenser
- Mod. DLC caustic-soda automatic dispenser
- Preparation/recovery plant

It is preset for linking with the "Galileo" host computer station for integrated dyehouse management.

The automatic control system can be partly overridden to operate parts of the plant (color kitchen, P/R plant) manually without interrupting the machine's automatic cycle.

C-Volumetric salt dispenser

Mod. DSC 350

D-Linear/exponential dyes and alkali dosing system Mod. DLC.

The two devices are used respectively for dispensing powder or crystals salts (sodium chloride, sodium carbonate, sodium sulphate) and dosing for dyeing mercerized cotton with reactive dyes or vat dyes. DSC it is mounted on wheels for transport within the dyehouse.

Salt amounts to be metered can be preset with timers and push-buttons, or controlled by the machine's microprocessor via a waterproof multiple-pin connector.

DLC can be supplied as standalone unit or embodied into LP color kitchens.

DLC provides controlled dispensing:

- Linear rate of increase
- Exponential increasing
- Exponential decreasing

The new techniques encourage dosing of dyestuffs for critical colors in high-affinity conditions.

E-Chlorite vapor scrubber

As the APPC-LV Series cabinets are air-cushion pressurized and made of high grade stainless steel they are frequently used for bleaching with stabilized sodium chlorite.

The scrubber automatically dissolve the sodium dioxide vapors and prevent their release in the dyehouse environment.



Automatic coupling system between No.2 APPC-LV 250

F. Automatic coupling system

With the automatic coupling system for extended dye batches, the liquor is circulated among machines of the same capacity by means of automatic valves, pipings and a mixing pump.

The coupling system is centrally controlled by one of the electric boards of the machines (master/slave).

Operating conditions are synchronized (flow rates, temperatures, etc.)

The system is complete with piping and automatic valves to equalize liquor levels and static pressures.

G. Loader with volume reducer

Permits dyeing small lots with similar liquor ratio with respect to the cabinet's total capacity. It is suited for small cabinets (Models 25, 50), and reduces their capacity by 50%.

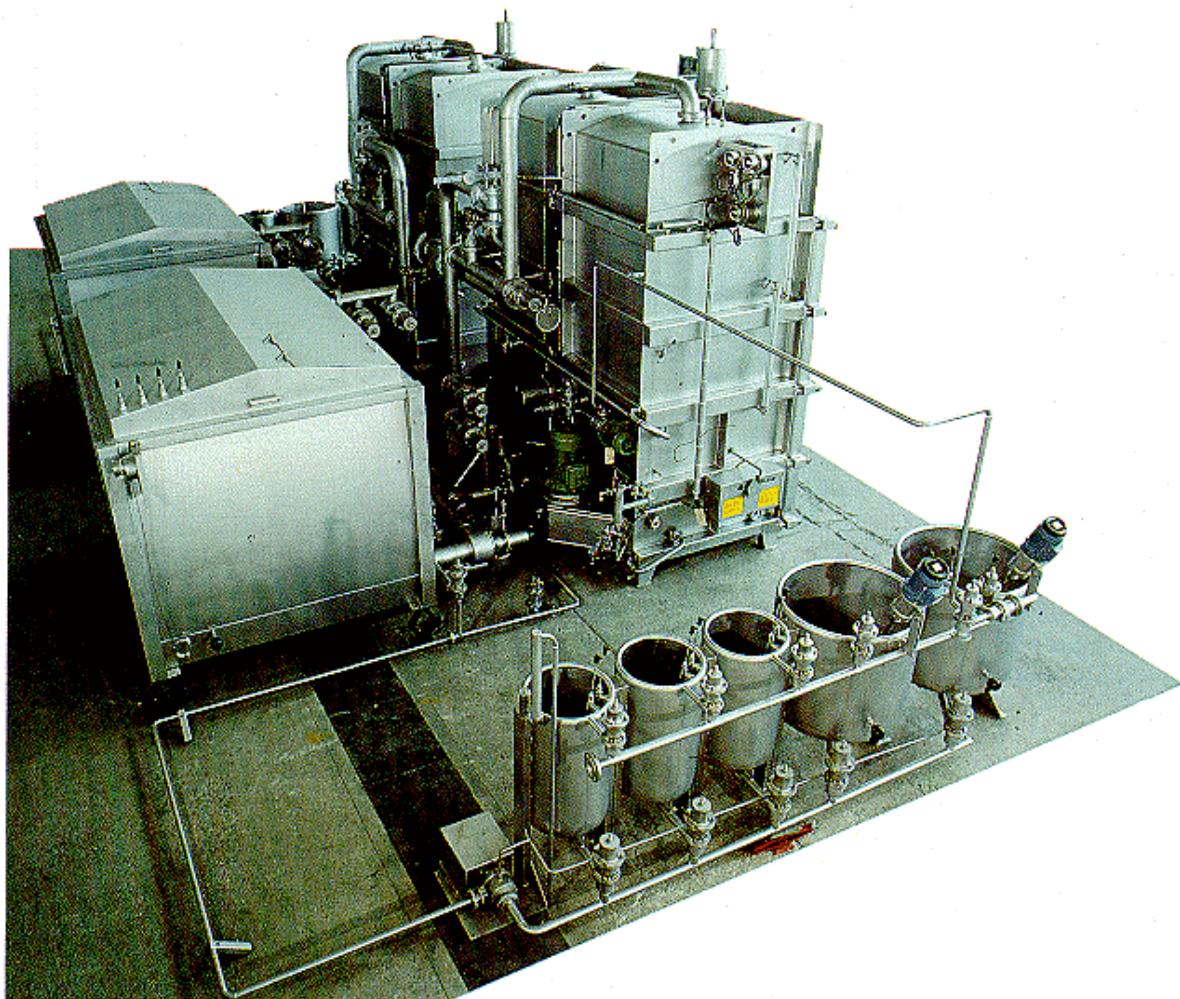
H. Supplementary valves.**Heat recovery presetting.**

Besides the standard servo-controlled pneumatic valves, the following can be supplied:

- Double drain valve, to automatically separate the exhaust waters according to their temperature (cold water to drain, hot water to heat recovery).

- Double overflow valve with thermostatic probe, for heat recovery when dyeing acrylic yarn with rinse stage and simultaneous cooling by continuous cold-water flow.

The first-drained, high-temperature liquid is fed to the heat recovery system; the probe automatically conveys the cold rinsing water to drain.



No.2 APPC-LV 250, capacity 350 kgs/each with automatic coupling system and 5-tank local

I. Loaders for static dyeing of pantyhose

For rapid dyeing of normal and stretch-polyamide hosiery and pantyhose, the APPC-LV Series cabinet uses perforated drawers or loaders with perforated separation plates.

Drawers permit VLS variable loading in APPC-LV cabinets from 20% up to 100% of capacity.

K. Equipment for laboratory and sample lots

The following are available to handle small lots:

- APP 12-LV

Capacity: 20 kg yarn approx.
Air-cushion pressurized; adjustable liquor ratio. Technical characteristics as for the industrial-size equipment. No pull-out magazine. Designed for the industrial reproduction of dyeing recipes.

Mounted on AISI 316 stainless steel supporting frame for rapid installation and startup.

- APP 5-LV

For sampling.
Capacity 7 kgs approx.
Pressure 0.4 Bar, temp.110°C.

- APP 2-LV

For laboratory tests.
Operating pressure 0.4 bar, max. temperature 110°C.
Capacity 2 kg yarn approx.

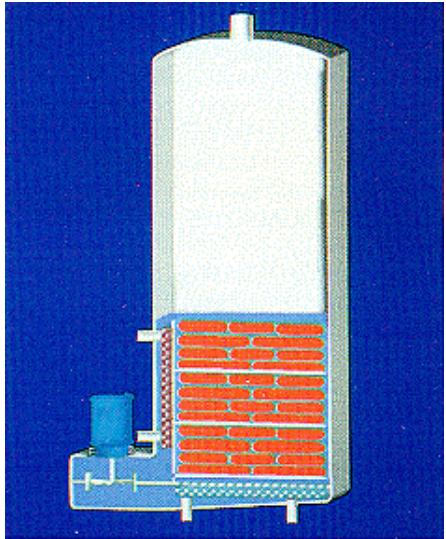
L- Overpressurized versions for high-altitude operation.

Several Loris Bellini cabinets operate in high-altitude factories in Mexico, Colombia, Ecuador and Peru.

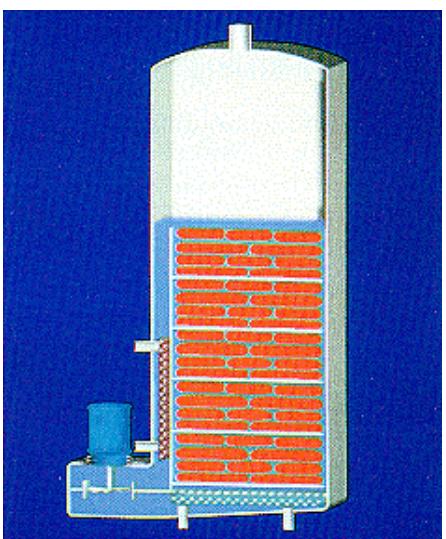
In order to reach 104°C at 2500 to 3000 meters above sea level, APPC-LV can be manufactured on request with oversized pressure rating.

VARIABLE LOADING AT CONSTANT LIQUOR RATIO OF PANTYHOSE

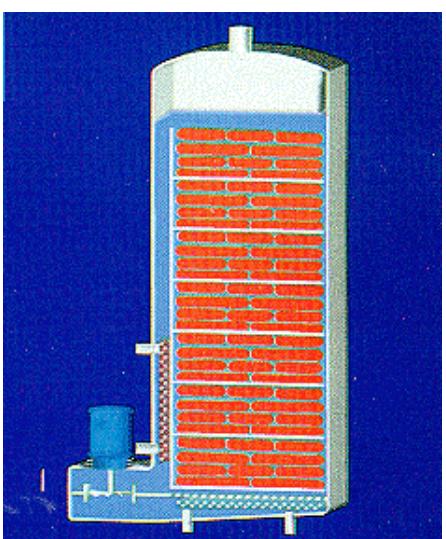
*Modular loading
3 drawers*



*Modular loading
5 drawers*



*Full loading
7 drawers*



STANDARD MACHINERY FEATURES.

Models	25-50-100-115-125-200-230-250
Loading capacities	20 up to 420 kgs/batch
Operating pressure officially certified	0.4 Bar (ISPESL standards)
Testing pressure	0.6 Bar
Operating temperature upto	110°C at sea level
Dyeing chamber thickness	6 mm
Manufacturing material (100%)	AISI 316 stainless steel
Automatic pneumatic valves	All functions except sampling port.
Level controls	Automatic
Electric motors	High power-factor
Motor protection	IEC Class IP54
Control board casing	AISI 316 stainless steel
Motor control	Magnetothermic relays (no fuses)
Heat exchangers	Two for each chamber
Heating rate	One for indirect heating
Cooling rate	One for indirect cooling
	2.75°C per min (from 15 to 80°C)
	2.00°C per min (from 110 to 80°C)



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