



# **RBNV-I**

## **VERTICAL DYEING SYSTEM**



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The pioneering in 1985 of **fully automated and robotized yarn dyeing plants based on RBNV dyeing machines** and the realization of numerous large plants in the last 30 years, have proven the market impact of this innovative system, backed by years of technological research and development activities and continuous

dedication to all details of engineering, manufacturing, testing and servicing.

Performance, reliability and technological life are based on a wide range of major technical features summarized in this pamphlet.



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*Fully robotized dyeing plant for worsted bumps and weaving yarns.*

*No.18 RBNV dyeing machines with VLS variable loading and coupling systems. Batches from 10 up to 1400 kgs per color.*

*Robotized material transport systems from greige warehouse till delivery.*

*Centralized kitchens HP linked with computer dispensing of powder dyes and liquid chemicals.*

*Host computer with Tintoretto software package for dyehouse planning and management.*

## AIR PAD PRESSURIZATION

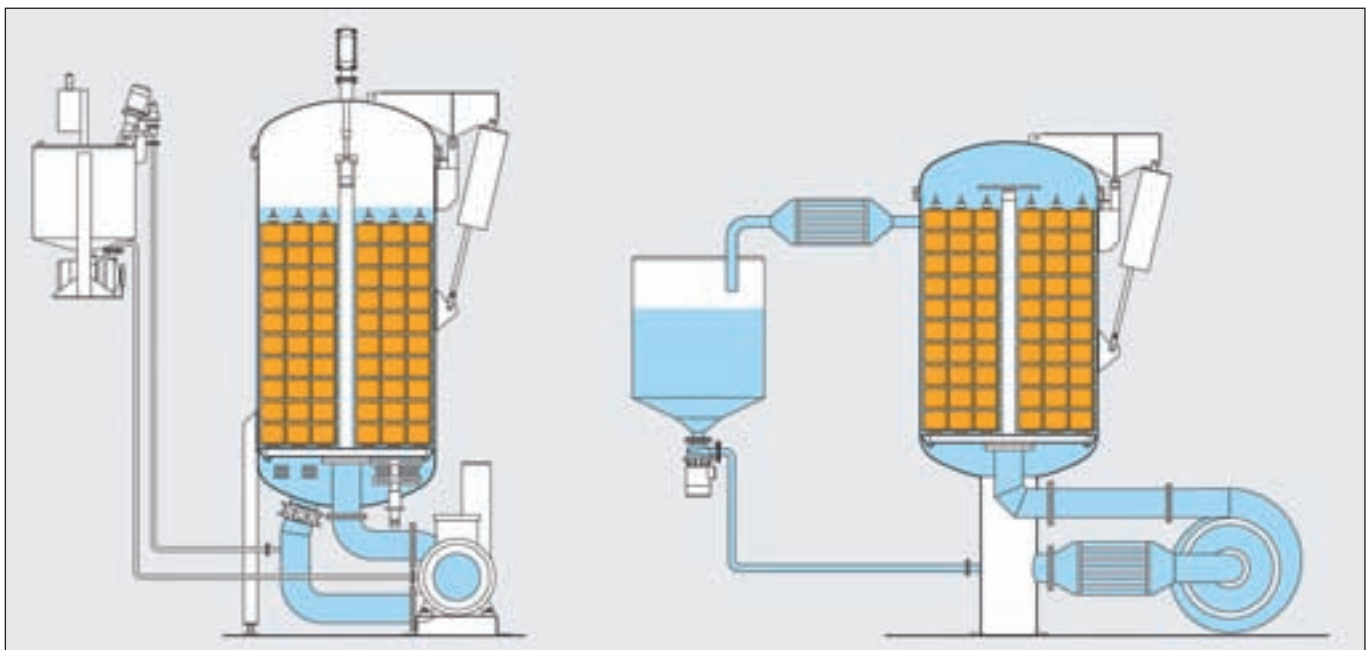
RBNV-I, as all Loris Bellini dyeing machines since the beginning of the 50's, is Air Padded. RBNV-I dyeing machine can be rapidly pressurized at 5 Bar at low liquor temperature. The relevant advantages to this solution are:

### 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. **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 tank colour-kitchen.

Dyestuffs are injected into the highest turbulence point of liquor circulation pump, in order to originate an intensive stirring effect.

- Air Pad Pressurization allows the machine to be **standard** equipped with dynamic **HYDRO-EXTRACTION DEVICE** by compressed air:
  - Elimination of unfixed dyestuff increases colour fastness.
  - Preliminary water squeezing which avoids carrier dropping and helps the centrifuging operation.
- **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/ reheatin.



## ADJUSTABLE LIQUOR RATIO

Liquor ratio is adjustable to optimize processing condition, by means of automatic liquor level control.

Level control is of continuous type and liquor level can be preset along the full height of the kier.

RBNV-I operates at:

### A. Low liquor ratio during dyeing phase

In dyeing phase RBNV-I dyeing machines operate with liquor ratio from 1:4 to 1:8 in function of yarn package density.

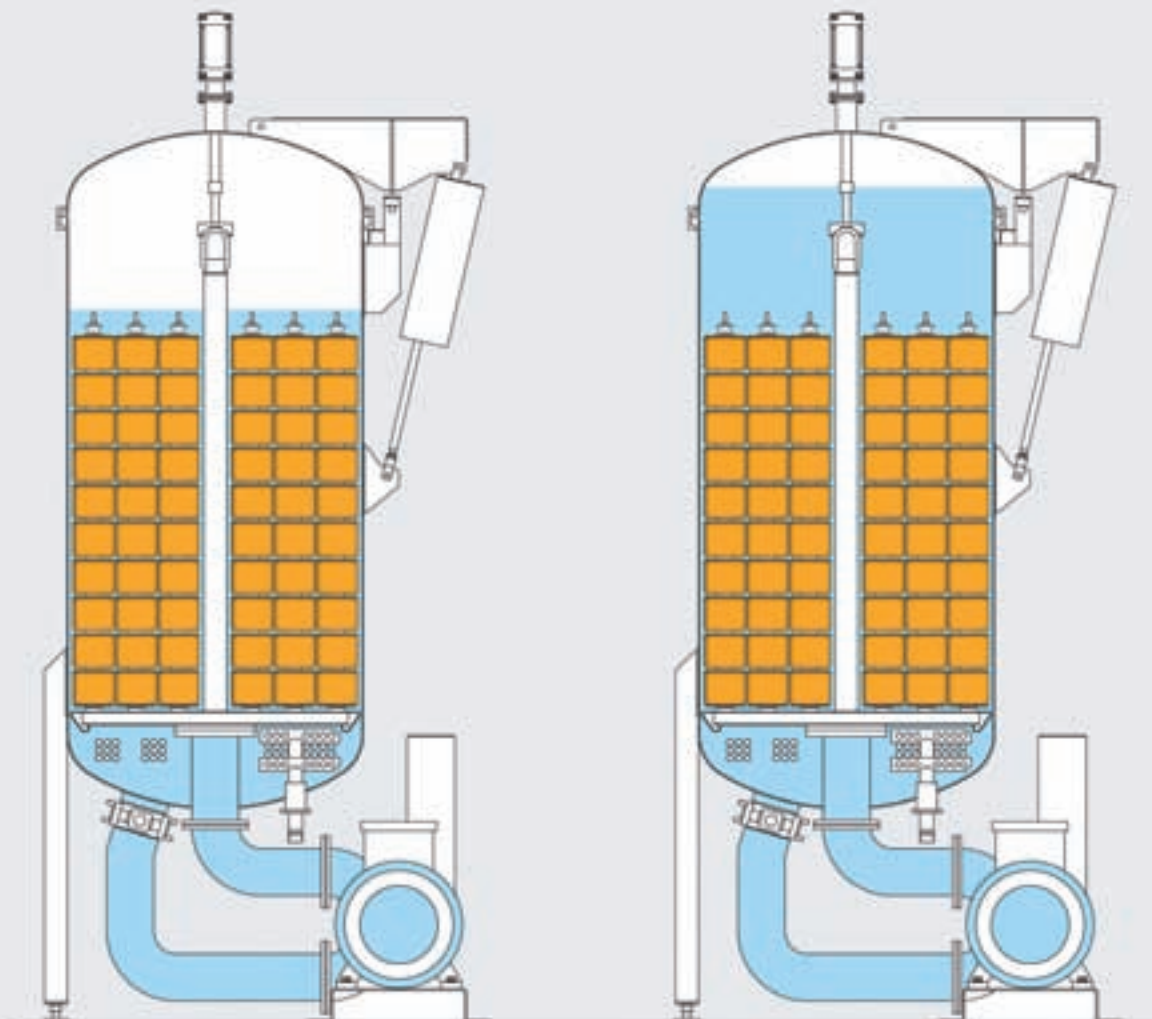
Low liquor ratio during dyeing saves process water, steam and auxiliary products added in fixed concentrations in relation with liquor volume (detergents, salts, etc.) and determines economical dyeing costs.

### B. Higher liquor ratio during wash-off phase

Adoption of higher liquor ratio during wash-off phase improves the solubility of unfixed dyestuffs.

Higher liquor ratio allows for performing soaping and wash-off phases after cotton dyeing with fibre reactive or VAT dyes at a liquor ratio ranging from 1:8 to 1:13, with substantial improvement of colour fastness and reduction of total dyeing times.

Besides continuous level control, RBNV-I can be filled with a set volume of water by an optional water predetermined-counter.

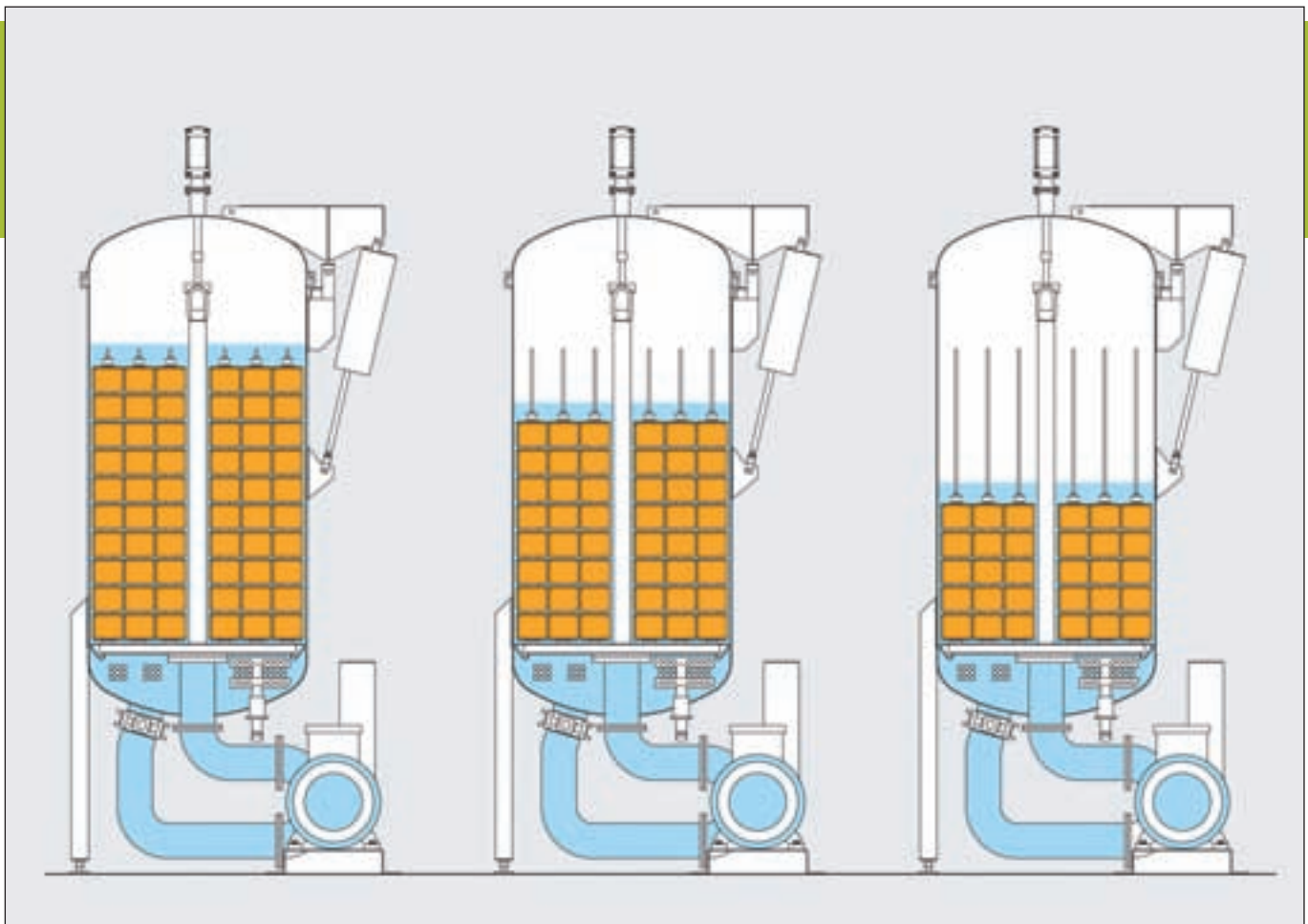


## FLEXIBILITY

Quick response to market demand has made flexible loading mandatory. RBNV-I machine operates at will with full load or reduced load in conditions of practically constant liquor ratio. The machine operates at:

- Half load
- Reduced load
- Full load

The variable loading system **OPERATES ON ALL KINDS OF MATERIALS** to be dyed, as rigid or compressible yarn packages, tops, bumps, loose stock, tow, with the adoption of interchangeable modular dyeing carriers. Pump flow rate is regulated to remain constant at reduced load. The **AUTOMATIC COUPLING SYSTEM** with total liquor exchange among two or three RBNV-I machines permits to extend further the flexibility for dyeing of large batches.



VLS Variable loading System dyes at constant liquor ratio and flow rate.



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## HELICOCENTRIFUGAL PUMP

The heart of RBNV-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 fibres 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 sy-

stem (**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 RBNV-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 in-

creases 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 colour 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 fibre (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.
<b>1.8 kg</b>	<b>3.6 kg</b>	<b>1 kg</b>	<b>2 kg</b>	<b>4,3 kg</b>	<b>750 gr</b>



## MODULAR DESIGN

RBNV-I dyeing machines are engineered for modular construction on the basis of autoclave internal diameter and useful dyeing carrier height.

Standard industrial machines can be selected among a series of optimized sizes, which ensure to always operate in the most convenient MLR conditions, according to the package type and size. Special dimensions according to Customer's requirements are available on request.

Large size machines, **up to 2500 kg/batch in single kier**, can be supplied on demand

MODULAR CONSTRUCTION is extended also to:

- Liquor circulation pumps
- Automatic pneumatic on-off valves
- Additional tanks
- Liquor preparation/recovery tank and relevant transfer pumps

The modular design determines a homogeneous, reliable and expandable system for integrated dye-houses and allows an easier technical assistance, as well as a more reliable spare parts and service management.

## INTERCHANGEABLE DYEING CARRIERS

RBNV-I dyeing machines use interchangeable carriers for:

- **yarn packages** (cylindrical conical, biconical, compressible types) diameters from 110 to 270 mm
- yarn on **muffs** and **cheeses**
- **Worsted tops with bumps up to 50 kg**
- **Loose stock fibre**
- **Tow**
- **Yarn warp beams and fabric beams**
- Special applications as ribbons (decoration and zippers), roving slivers (linen), cotton loose stock (medical cotton-wool) etc.



## MACHINE PROCESS MANAGEMENT

### "Leonardo" Industrial PC machine controller.

RBNV-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.

## OPTIONS

RBNV-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 RBNV-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.
- 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).

## RBNV-I FEATURES:

- **Standard design and manufacturing features:**
- **Nominal loading capacities from 5 to 1500 kg.**
- **Dynamic Hydro extraction Device.**
- **Pressure rating of 5.0 kg/cm<sup>2</sup>, up to 160°C temperature, temperature lock at 140C.**
- **Construction in AISI 316 stainless steel, for all the part in contact with dyeing liquor.**
- **Water protected motors (IEC Standards IP54).**
- **Waterproof electrical equipment (IEC**
- **Three-level safety systems.**
- **Magneto-thermal motor protections.**
- **Heat exchangers rated for 15.0 kg/cm<sup>2</sup> operating pressure.**
- **Heating gradient 5°C./minute (range 20-80°C steam pressure 6.0 kg/cm<sup>2</sup>) Cooling gradient 3°C./minute (range 130-108°C water temp. 15°C, pressure 1.5 kg/cm<sup>2</sup>).**
- **Pneumatic lid lifting and lowering.**
- **Rapid lid locking system.**
- **Design, manufacturing and testing in accordance with: PED/97/23/CE, ASME-CODE International Pressure Vessel Standards.**



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