VERTICAL YARN DYEING MACHINES MOD. GS
These vertical dyeing machines are the result of a continuous improvement working in straight contact with big dye-houses and big groups both in Italy and worldwide.
In these machines, working with air pad system, bobbins are charged completely submerged into water and air is never in contact with material, while air pad pressure is maintained perfectly constant and regulated by controller.
Air pad is free volume to expand bath with temperature increasing, without using external expansion tank.
There are many advantages using air pad system.
Bath is never in contact with external air and so is not oxidized and this is important especially when reactive dyeing.
Liquor ratio can be changed increasing level inside kier: in figure you can see kier with low medium and high liquor ratio.

There is low energy consumption and steam consumption, because kier is not completely full of bath and bath is never cooled down and then heated up because no need to circulate into expansion tank.
With air pad is possible dyeing full and reduced loads at constant liquor ratio saving more in steam, electrical power, water and in chemicals and dyestuff.
Bath circulation is from inside to outside and from outside to inside of bobbins allowing an uniform dyeing of material in all material depth.
Bath inversion is automatic, never stops main pump and is freely programmable in time (internal and external circulation time) and in speed (internal and external speed).
Also bath inversion is soft avoiding turbolences inside kier.
Machine is feed from single tank nearby the kier or from remote colour kitchen and all introductions are automatic using introduction pump.
All tanks levels are analog allowing an optimal control of product quantities injected in machine.
All products are injected in maximum turbulence point of main pump.
As you can see in figure machine works from minimum load to maximum load with constant liquor ratio.
Machines have been designed to work with liquor ratio from 1:4 to 1:14 following customer request.
Pump is designed to work with low flow and big prevalence to dye materials like rayon, cotton, linum and can work also with big flow and low prevalence to dye materials like wool, acrylic, polyester. This is obtained only changing inverter speed.
Pump is completely in stainless steel with carbon vidia seal and viton orings.
Pump volume and inversion device volume are kepted low allowing small liquor ratio also at minimum loads.
Magnetic flow meter (see figure), allows to regulate pump speed keeping constant flow through material; it can be set in liters/min or liters/min*kg. This instrument is connected as input to controller.

Differential pressure electronic transmitter, DP, connected to controller, allows dyeing while keeping constant value of differential pressure In to OUT and OUT to In separately. It permits dyeing with constant flow, also when changing machine load from minimum to maximum or changing material density. Inverter speed is automatically varied to obtain constant differential pressure.
Setting a value of differential pressure in controller, when bobbins density changes with temperature flow will increase causing mechanical deformation of winded material and dye centres mechanical deformations.
To avoid this is necessary to limit flow with flow meter.
So using together flow meter and differential pressure measurement machine can dye every kind of material in all load conditions.
Also dyeing is done under optimal conditions to save electrical power because inverter power is always controlled to achieve desired flow values.
Machines can be fitted also with air squeeze function to eliminate water after dyeing using compressed air
There are many advantages: no leaks of carriers which can be easily moved to hydro extractors or dryers. Time of hydro extraction with centrifuge machines is reduced and so there is energy saving and also non fixed colorants after dyeing are eliminated and so they do not oxidate when carriers are extracted from machine.
This process is fully automatic (step from controller) and is obtained pressurizing 6 bars the kier and then suddenly depressurizing inside part and so air is forced to circulate from outside to inside. Residual water s drained from a separate line from drain
In table is possible to see machine models covering a range from 12 to 1000Kgs changing kier diameter and height, carriers number and dimensions and pump power/delivery.

<table>
<thead>
<tr>
<th>GS models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Models</td>
</tr>
<tr>
<td>Kg max</td>
</tr>
<tr>
<td>N° carriers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>GS 180</th>
<th>GS 300</th>
<th>GS 500</th>
<th>GS 700</th>
<th>GS 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg max</td>
<td>168</td>
<td>312</td>
<td>500</td>
<td>728</td>
<td>960</td>
</tr>
<tr>
<td>N° carriers</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Every kind of bobbins can be used: cylindrical, trunk conical, compressed
As seeing in figure when kier size is more than 300Kgs, carrier is double

Kind of carriers:

1 - for biconical bobbins
2 - for cylindrical bobbins
3 - for cheeses
4 - for tops
5 - for bumps
6 - for looses fibres in overlapping modular basket
7 - for loose fibres or hanks packed in extractable spacers suitable for hydroextracting apparatus

Kind of spindles
Machines can dye all kinds of materials, bobbins, hanks, tow, top in bumps, zippers, ribbons, fabric, hairs changing kind of carriers.
In all machines is present overflow rinsing function using a valve placed in top of the lid, water input in kier is opened from bottom and pump circulating from inside to outside. On this way perfect cleaning of machine is guaranteed and also complete washing of material after dyeing
Automatic closing and open lid under 3 safety conditions (pressure, temperature and volume), so cycle is completely automatic from loading to unloading.
Lid has interlock device which can be automatic or manual
Also carrier is automatically locked inside the kier with a piston during dyeing cycle.
Analog volume / level sensor device is located inside the kier to control on line during the process the liquor level within +/- 0.5% tolerance.
Drain and filling machine are optimized in speed to speed up whole process.
All machines can have multiple input waters and there is normal drain and hot drain line.
Normal drain goes to water treatment system and hot drain water can go directly to heating recovery system.
Hot drain is useful to eliminate oligomers after dyeing poliester
Hot drain line is controlled in temperature and can be equipped with cold water input and mixer box to cool down drain temperature.
Multiple drains are automatically selected from controller.
Machines have flow back function from kier to tank controlled in level and safety and this is useful when multiple injections are necessary during the process without changing liquor ratio.
Sampler: capacity 300cc for each kier, complete of nr. 3 manual ball valves, (2 for bath circulation and 1 for drain) with safety device. Also available of one bobbin size and with small circulation pump.
Machines are air pad, but can be ordered with external expansion tank and working fully flooded mode with pressure static pump or working air pad and fully flooded together
Machine can have one or multiple external tanks and also can be equipped with tank same volume as kier (110 % stock tank)-
This preparation tank allows to prepare bath before previous batch is finished, increasing machine productivity
All tanks can be heated and mixed and can have multiple input waters.

Injecting prepared bath from big tank into machine is very fast because injecting pump is optimized in speed.
All tanks have analog level control so all products injected in machines are controlled in quantity and all dosing curves are present (linear progressive regressive).
Each tank is equipped with water valve for rinsing, drain valve, transfer valve.
All machines can be coupled, doubling loading capacity.

All kind of dyeing controllers or industrial PC can be fitted in electrical panel.

Technical data

Maximum temperature: 140 °C
Maximum pressure: 5 bars
Machine completely in stain steel AISI 316 L
Max working pressure heat exchanger: 15 bars
Motors: IP 55 insulating class H (210 °C)
Heating gradient from 0.1 to 6 °C/min. Max gradient with 6 bar saturated steam
Maximum cooling gradient: 6 °C/min with 20 °C water
Circulation pump designed to achieve 40 lts/Kg*min at maximum load and standard density.