mixers and metering units for lamination
	solventless, solvent-based & monocomponent
lamination: a simple process?

critical elements in the process

- raw materials for lamination
control on the adhesion and surface tension
- laminating machine
good mechanical construction and parallelism within rollers
accurate tensions controls according the materials to run
- adhesives
to fit the requirements of the structure to laminate

that’s normally the big issue:
to mix them on an accurate ratio!
mixers: general description

the lamination “problem” = adhesive control

• control on the % ratio within the components to prevent curing problems

• right amount of adhesive to be delivered (g/m2) to prevent delamination problems (less g/m2) to prevent problems on the reels (too much g/m2)
mixers: general description

the traditional solution

- piston pumps technologies
  several designs based on mechanical regulations on the flow ratio
  not accurate and not reliable, very difficult to change the flow ratio, a lot of maintenance to insure quality dosing

- piston pumps + flow controls
  to insure the flow to the inaccuracy of the piston pumps
  so it shows the limitations for piston pumps
mixers: general description

so, the traditional solutions are:

• tedious and expensive in maintenance
  piston pumps are very maintenance dependant for reaching a consistency in the metering

• not always accurate
  piston pumps are not reliable and are not accurate for further calculations such as production controls and g/m2

there’s a much better way ...
Mixers: our design criteria

Main design criteria for a mixing unit (lr.products) believes should be:

- Accuracy
- Reliability
- User friendly
- Maintenance free
mixers: general description

gear pumps & cnc technology which allows the mixer to:

• control in line the g/m2 by means of the real calibration based on the temperature and the accuracy of gear pumps
• total control over the mixing ratio sensors will provide information on the motor rotations for each pump on the fly ratio changes are not a problem
mixers: general diagram

- PLC control
- permanent level control
- removable tanks
- double temperature control
- component heating elements
- double frequency variators
- rotation sensors
- gear pumps
- pressure sensors
- double hose
- hose temperature control
- anti moisture filter
mixers: the way they look

- 2 component adhesive tanks
- LCD integrated touch screen
- Ultrasonic sensors
- Stainless steel construction
- 2 hoses for independent adhesive flow
- Easy to move
mixers: the way they look

siemens touch screen

double frequency variators

siemens S7 PLC

cnc controls & gear pumps allow the customers to reach the highest levels of quality
mixers: gear pump description

- custom made
- special alloy
- very accurate
- 20 cm³ per revolution
- no maintenance
- allows warming up

the most important part of the mixer
mixers: gear pump description

theoretical accuracy level:

- 1 pump revolution = 20 cm³
- 30 motor revolutions = 1 pump revolution
- 30 revolutions = 20 cm³
- 2 control pulses = 1 revolution
- 60 control pulses each 20 cm³

The electronic is able to handle a volumetric control of 20 cm³ / 60 pulses = de 0,33 cm³

taking into account a density 1,2 g/cm³
the amount of grams the unit can control is 1,1 g/cm³ x 0,33 cm³ =

0,36 g. !!!!!
mixers: gear pumps (metering)

critical issues for a proper gear pump operation:

1: constant flow pumps
    pump flow should not be dependent on the adhesive density

2: CNC numerical control
    in order to guarantee the right ratio of components, also not depending on the application flow and the final amount of adhesives delivered
mixers: gear pumps (metering)

critical element 1: constant flow

- To use high quality pumps and high accuracy pumps, it's mandatory.
- Higher viscosity will require higher pressure on gear pumps.
- Lower viscosity will require lower pressure on gear pumps.

Graph showing the relationship between flow, viscosity, and pressure.
mixers: cnc numerical control

Critical element 2: gear pumps regulation

Without any regulation on the cycle, the final ratio will be OK only if the metering time is big enough. The critical element is very much depending on the final metering amount and very much depending on the components viscosities.

- Component A: higher viscosity
- Component B: lower viscosity

The graph shows the speed over time, with acceleration, metering, and slowing down phases. The cycle is critical and must be monitored carefully to ensure the final ratio is acceptable.
mixers: CNC numerical control

with a conventional ramp control

final ratio will be OK only if the metering time is big enough

very much depending on the final metering amount

KO

OK

KO

speed

100

80

component A

component B

acceleration 1 s. metering 3 s. slowing down

time
mixers: cnc numerical control

un control CNC completo sobre el ciclo de las bombas

Component A ratio will be OK during all metering time.

Component B it is not depending on the metering amount.

speed

100

80

acceleration 1 s. metering 3 s. slowing down

OK OK OK
mixers: mixing head description

- simple mixing head
  (no valves to get blocked)
- 2 independent adhesive hoses
  (mixing at the metering point)
- disposable static mixer
  (shown with metal shroud)
- temp control hose

It prevents the adhesives to harden on the mixing head and to cause a problem.
mixers: main control description

- adhesive level on tanks
- temperature set points
- hose temperature
- real temperatures
- real measured data
  pressure
  cm³
  grams
- % ratio
  showed and used as grams of hardener for 100 grams of adhesive
- alarms
mixers: equipment calibration

calibration, what’s that?
• it’s the relation between the weight for a certain volume
• in other words:
  the real density measurement at working temperature

why to calibrate?
• because density for the adhesive it’s related to the temperature
• we should know the real density value for the 2 components in order to
get real weight measurements
• technical sheets are giving information, but just at one temperature
• when calibrated, the operator can easily check the performance of the
  lamination process
mixers: equipment calibration

by using the calibration function, you will get the following advantages:

- real consumptions in volumes
- real consumptions in kilos
- accurate % ratio
  (information given by adhesive suppliers is always related to volume, not to weigh)
- system will not be dependent on viscosity
- average g/m²
- in line g/m² consumption
- accurate QC
  (no need to weight each reel and calculate the g/m²)
mixers: equipment calibration

how to calibrate?:
- stabilize the mixer metering by getting a continuous flow
- verify temperatures are the desired ones
- the mixer will deliver a certain amount of A y B by using the proper calibration head
- weight the A y B cups
- enter the weight data and push calibrate
- the software will calculate the density and make the changes

how often to calibrate?:
- it will work if temperature or adhesive are not changed
- it takes less than 5 minutes
- the mixer will work fine if you don’t calibrate it, but will not bring accurate information based on weights
- calibration it’s password protected
mixers: equipment calibration

you will also get a very interesting information for production and quality control

- average values
  - lamination time
  - adhesive pumping time
  - consumption in liters
  - consumption in kilos
  - laminated m²
  - lineal laminated m
  (all of this can be ink-jet printed or linked into the production network)

- average g/m²
  - for all the job
  - for instant values
mixers: g/m2 control

The information on g/m2 is graphed to show the operator the tendency and prevent any eventual deviation.

- The mixer QC software proved to be very useful on the field by helping operators in reaching the desired application of adhesive.
- It saves a lot of time and further delamination problems.
mixers: g/m² & adhesive savings

as the mixer is giving the operator real information on the g/m², it’s simple to work on the lower security area, so quite simple to save “some” adhesive ......

using +0.5 g/m² for security reasons means:
0.5 g/m² x 10.000 m² = 5.000 g = 5 Kg.
0.5 g/m² x 100.000 m² = 50.000 g = 50 Kg.
0.5 g/m² x 1.000.000 m² = 500.000 g = 500 Kg.

there is some money to save
mixers: weight control

user friendly =
very simple to double check the way the mixer is working

- dose a certain amount of the adhesive mixture
- check on the main mixer screen the A and B component indication for weight
- add together the two values
- weight the dosed adhesive mixture

if the equipment is working fine (which is normally the case...) both values should be equal
mixers: the full automatic process

in order to get a fully clean working environment and a reliable process, less operator dependant, we should make automatic the refilling operations on:

• **1:laminator**
  by means a sensor level (in the dosing rollers nip) which will tell the mixer to send adhesive to the laminator

• **2:mixer**
  by means two additional gear pumps to allow the mixer to refill automatically as a function of the signals given by the sensors on the adhesive tanks
mixers: **the full automatic process**

- **1: refilling the laminator**
  an ultrasonic level sensor on the dosing rollers is sending a refilling signal to the mixer which will automatically refill the laminator.

  this way, you can keep a constant level of “fresh” adhesive ready to use.

ultrasonic sensor
(maximum and minimum control)

dosing rollers on the laminator
mixers: the full automatic process

- **2a: refilling the mixer/transportation pumps**
  ultrasonic level sensors on the mixer are used as signals for refilling the tanks
  all the control is done by the mixer PLC
  by means of switching valves, 2 or more mixers can be refilled from the tanks

- mixer adhesive feeding line
- **1000 l. containers**
  (reusable)
- transportation gear pumps
  (automatic regulation from mixer)
- switching valves
  (to refill 2 units from 1 tank)
mixers: the full automatic process

- 2b: refilling the mixer/no pumps but valves
  transportation will be done by gravity

- pneumatic valves
  (automatic activation from mixer)

- big diameter refilling hoses

- capacity sensors
  (double security to prevent overflow)
mixers: the full automatic process

main advantages:

• you can use 1000 l. containers
• or 200 l. drums
  (less waist on packing and adhesive)
• fully automatic, no manual operation, user friendly
  (no moisture to get in as the tanks are never opened for refilling)
• less down time for refilling
• no maintenance for the transportation gear pumps
• fully clean operation
• integrated control in the mixer’s LCD touch screen
• full control on the operation process
• safer operation
mixers: the full automatic process

the very best solution

for a clean operation an accurate dosing and a reliable lamination process