

# Tailored CF/E Blanks for high volume manufacturing operation

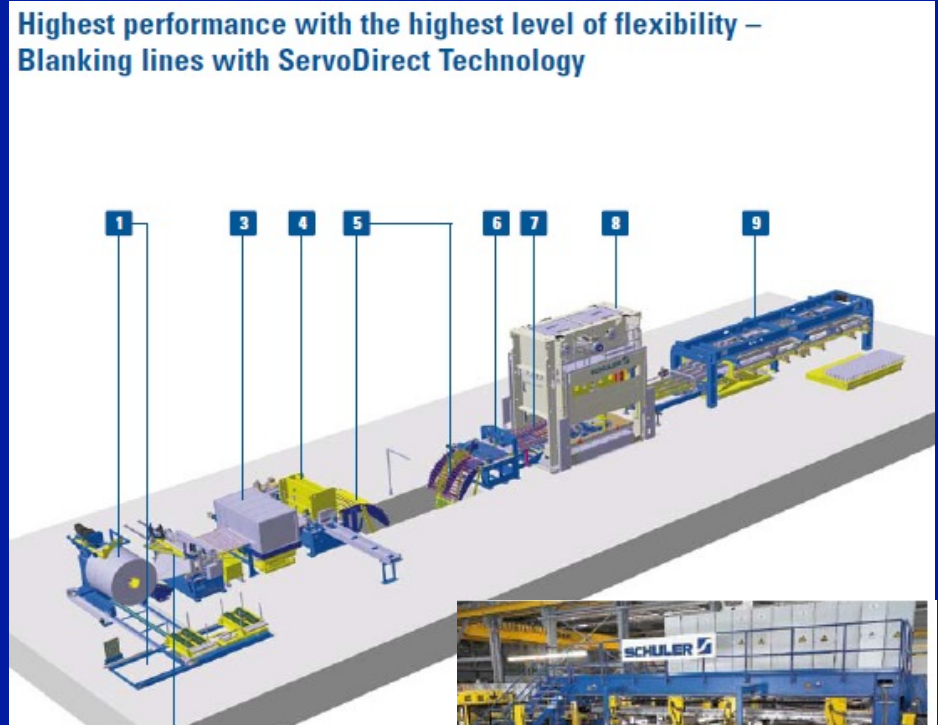
Description of the process and overview of the technology

# Overview

- Un-coil the CF/E material
  - B-staged with low/no tack from the material supplier
- Straighten the CF/E material
- Cut the Blanks
- Pre-Laminate the Large Blanks
- Pre-consolidate the Blanks
  - Hot Press & Cold Press
- High speed cut the component patterns
- Automated pick-and-place the lamination
- Pre-consolidate & B-Stage the Tailored Blank
- Deliver to the Progression die-line

# Un-Coil and Straighten

- Exceptionally similar to:
  - Existing sheet metal un-coiling and straightening operations
  - Material comes off the roll (large coil) tending to curl and will not lay flat
  - Straightening (in this case) will heat the material, flatten it and then cool it back down.
    - B-Stage cycle #1



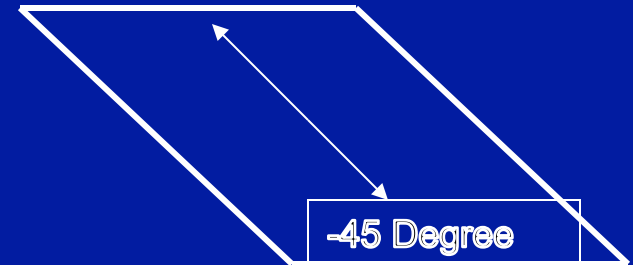
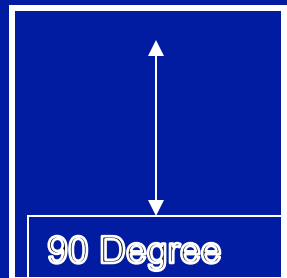
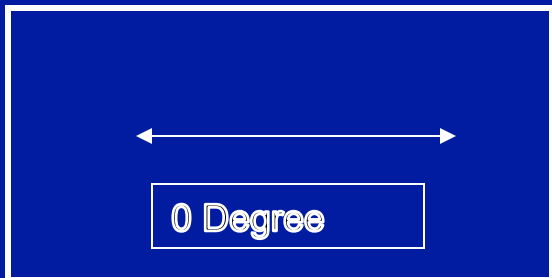
**SCHULER**

- 1 | Coil loading/decoiler
- 2 | Threading unit with scrap disposal
- 3 | Washing unit
- 4 | Leveller
- 5 | Loop-related equipment
- 6 | Roll feeding, Schuler Power Feed
- 7 | Telescoping roller conveyor
- 8 | Blanking press with ServoDirect Technology
- 9 | Stop2Drop stacking unit



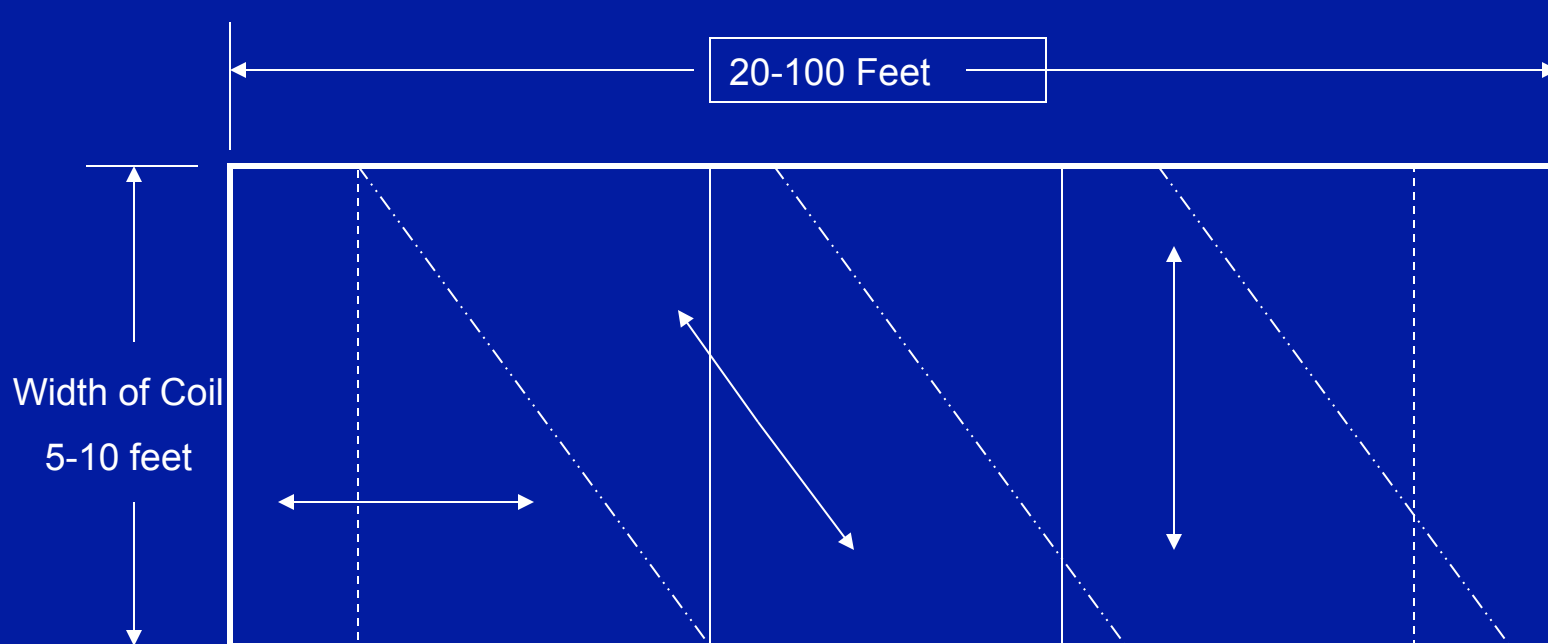
# Shear the Blanks

- Multiple fiber angles and very large area flat rectangular shapes
- 3-4 blanking & straightening set-ups per die-line
- Typically cut are: 0 degree, 90 degree and +/- 45 degree blanks/sheets



# Pre-laminate the Blanks

- The cut and oriented blanks are laminated into large/long stacks of CF/E Material
  - 3-5 plies thick



# Pre-consolidate the Blanks

- Process will “probably” utilize a large multi-opening press
  - Hot Platen press
    - Load 10 sets of pre-laminated blanks into large flat platen press
    - Apply required tonnage to consolidate (no resin flow)
      - Probably under full vacuum
  - Cold Platen press
    - Automatic transfer of hot material blanks into cold flat platen press
    - Apply required tonnage to consolidate and cool/harden material
      - Probably under full vacuum
      - B-stage cycle #2

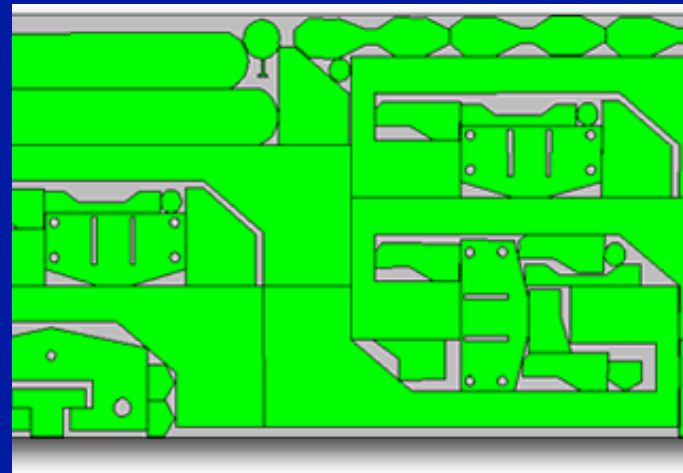
Note: Thickness of pre-consolidated blank now  $\frac{1}{4}$  to  $\frac{1}{2}$  of final part thickness, approximately 0.25 to 0.5 mm



European Woodworking Machinery Co.  
~20 opening flat panel press

# High speed Cut the Patterns (CNC 2-Axis)

- Complex nesting of all required shapes and fiber orientations will be in one pre-consolidated blank
  - High degree of complexity required to obtain maximum/optimum material utilization
  - Patterns will be darted and scarfed as required
  - Conveyorized material (blank) feed
  - Process “probably” will simultaneously cut multiple thicknesses of the pre-consolidated blanks
    - No need to simply cut one at a time



# Automated Pick-and-Place the Tailored Blank Lamination

- Exceptionally high-speed operation
- Multiple robots placed on/along the conveyORIZED assembly line
  - Suction cup pick-up of patterns
  - Heated tacking/staking the plies together after placement



- Unload Cut Parts
- Sorts Jobs Automatically
- Removes Cut Parts by Job
- Offloads Cut Parts to Pallets, Shelves or Conveyors
- Integrates With Dynamic Nesting Systems
- Removes Skeleton and Scrap
- Retrofits Existing CNC Cutting Operations
- Allows Unattended Material Handling

## Dynamic Robotic Parts Sorting

- Converts Nest Data to Robotic Paths Automatically
- Multi-Axis Robot and Controller
- Application Specific Grippers
- Configurable Safety Systems
- Optimizes Part Placement
- Stack Height Collision Detection
- Job Order Tracking and Reporting
- “Lights Out” Operation
- Maintains Job Order Integrity
- Improves Production Throughput
- Assures an Organized and Repeatable Process
- Seamless Process From Sheet, Nesting, Shape Cutting to Part Removal
- Reduces Operating Costs



**Magestic Systems Incorporated**



# Pre-consolidate & B-Stage the Tailored Blank

- Process will utilize “probably” a multi-opening flat platen press
  - Smaller presses than used for the blanks
    - size optimized for the individual tailored blank
    - May utilize simple mold
  - Tailored blanks enters the hot platen press
  - Cycle time controlled to achieve desired state-of-cure (B-stage)
    - Seconds (or minimum minutes) at elevated temperature
    - Probably under full vacuum
  - Hot tailored blanks immediately fed into cold platen press
    - Short cycle times freezing/hardening of the under-cured epoxy
      - (B-stage cycle #3)

# Deliver Tailored Blanks to the Progression die-line

- Tailored blanks “probably” loaded into large cassettes
  - Stacks of 20-120 tailored blanks per cassette
    - 10 to 60 minutes worth of product
  - Blanks are dry to the touch
    - Zero tack, not sticky
  - Blanks are stiff and rigid