Decorative Rotogravure

Rochester, NY
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Rotogravure Printed Products at Armstrong

Sheet Vinyl Flooring

Tile Vinyl Flooring
Decorative Rotogravure

Sheet Vinyl Flooring

- Wear Layers
- Ink Film (Printed Image)
- Expanded Vinyl Foam
- Felt / Paper Backing

Applying expandable vinyl layer to felt → Printing vinyl coated felt → Applying wear layers to printed vinyl → Heating to expand foam & cure wear layers → Mechanically embossing

Decorative Rotogravure

Tile Vinyl Flooring

- Vinyl Film Wear Layer
- Ink Film (Printed Image)
- Limestone Tile base

Reversing print vinyl film and pad coat → Laminating and mechanically embossing film to tile base → Die cutting tile into appropriate sizes
Armstrong World Industries has 3 rotogravure presses in the United States.

**Egan, 6 station, 12 ft wide** – Lancaster, PA
Print 12 foot wide sheet vinyl rolls approximately 1000 linear yards long.

**Kochsick, 8 station, 14 ft wide** – Stillwater, OK
Print 12 and 14 foot wide sheet vinyl rolls approximately 1000 linear yards long.

**Cerutti, 9 station, 40 in wide** – Beech Creek, PA
Reverse print 40 inch wide clear vinyl film for tile approximately 3,000 linear yards long.

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**Decorative Rotogravure**

**Flooring Design**
Consumers of vinyl flooring are generally looking for one of two types of design.

- The realistic replication of other flooring material, like stones, ceramic or wood.
- Something unique that can only be printed.
Image Capture

• The first step in flooring design is digital image capture. Models and original artwork are scanned at high resolution to create an electronic image.

Photoshop Design

• Product designers use Photoshop to finalize designs put them into a repeat to fit the cylinders.
• Flooring designs require a continuous image across and around the cylinder so the seams are not noticeable. This is most important with woods and overall images.
Photoshop Design

- Because our cylinders are large and expensive, we use the same set of cylinders to print up to 5 or 6 different colors.
- The separation must also be able to handle movement of the sheet up to 20/1000". Trap must be built into each separation.

Color Work

- Until 2006, all color work at Armstrong was done using lab prototypes made with a flat bed rotogravure press. Plates were engraved and prototypes were made using raw materials from the plants. It took approximately 3 to 4 weeks and a few thousand dollars to develop a color line using this method.
- Now, color work is done digitally using software designed specifically for using spot colors in rotogravure. An entire color line can be developed in under two weeks.
New Designs to Production

• After separations are complete and designs are ready to go to production, a team consisting of manufacturing, design and tooling plans engraving and printing specifications.

• This team determines the engraving specifications and print order taking into account design visual requirements, registration, drying and overprint.

• Balancing design requirements against manufacturing capability is very important. Not having the appropriate balance can result in sending a design to production that can’t be produced consistently or one that creates a large amount of scrap. Equally a concern is loosening design requirements to the point that the design has lost its original intention and does not sell, but is easy to reproduce in manufacturing.

• Besides loss of productivity, our biggest reason for keeping manufacturing problems from occurring is that our product at retail is more than $20 per square yard. The average size of a manufacturing roll is 4000 square yards.

Ink Coverage vs. Drying

• Heavy ink coverage in designs like woods can sometimes exceed our maximum coverage of 300%.

• The challenge in achieving the correct color without affecting drying is critical. If the ink doesn’t dry before wind up, the felt backing can transfer fibers to the printed surface. Also, tacky material going through the press can cause the web to jump creating registration issues, both resulting manufacturing scrap.

• Also a concern is the use of pearl inks. In order to achieve the flash from the pearl, we need to put down more ink than usual. We need to place the pearl cylinder early in the press where the ink has plenty of time to dry before wind-up.
Image Fidelity vs. Registration

• The designer and printer often have discussions on whether or not the appropriate amount of the trap is built into the design. The printer wants the design separation to allow a lot of web movement and the designer wants tight registration to maintain the realistic look of the floor.

• Because our designs have a significant trap to handle web movement, we need to make sure the cylinders that create the definition of the image are close together. Otherwise the image can appear blurry.

Line Screen and Cell Configuration

• Line screen is also something we define in our pre-press meetings. We generally use 120 to 135 line screen with sheet vinyl printing and 150 with tile printing.

• Because our sheet vinyl structure is foam-like, line screens over 135 do not provide a significant visual advantage.

• In sheet vinyl printing, we often blend a variety of line screens in a single design. We use 120 line for a cylinders that lay down most of the color, 100 line to carry extra ink for pearls and inhibitors and 135 line for our cylinders that carry the detail or image definition.

• Cell configuration is something we determine based on the separation image. While trying to avoid moiré, we also take advantage of how the cell structure releases ink in order to enhance the particular characteristics of an image.
Cylinder Engraving

- Because of the small number of cylinders we engrave every year (less than 200), we do not have in-house engraving. We have two suppliers in North American that can accommodate the size of our cylinders.
- Our cylinders have engraved widths of 40 inches, 12 feet and 14 feet. Our largest cylinders are just over 18 feet long including journals weighing up to 9000 lbs.
- Our cylinders are engraved with an electro-mechanical engraving machine with a single engraving head. A single head is required because the design must be seamless across the cylinder. Engraving our large cylinders can take 10 to 12 hours.
- A set of 5 cylinders can take more than a week to copper, engrave and chrome.

Cylinder Storage and Handling

- Handling and storage of our large cylinders a challenge. We have approximately 350 cylinders in our Stillwater Plant and 500 in our Lancaster Plant.
- Cylinders can only be transported by flat bed truck with a maximum of 5 per truck.
- Strong boxes and good drivers are critical factor in transporting cylinders of this size. We’ve learned this the hard way over the past couple years. With the increase in fuel costs, fewer truck drivers are willing to take one-way shipments to and from our Stillwater Oklahoma plant.
Material Handling

• For sheet vinyl, we manufacture substrates that are a minimum of 30 mils thick.
• Roll lengths average approximately 1,000 linear yards and weigh 7,000 lbs. At 12 to 14 ft. wide, handling rolls of this size is also a challenge.
• Rolls splices are done manually requiring large accumulators (or festoons) to maintain press speed.

Press Control

• Our sheet vinyl presses print at speeds around 200 ft./min and our tile press up to 700 ft./min. Both are slow compared to publication presses which can run up to 2000 ft./min.
• Because our material costs are high, registration is manually assisted to minimize start up scrap. Only 2% start up scrap is permitted.
• Presses are continuously monitored by inspectors throughout the run to look for and eliminate defects.
• Viscosity is also measured and adjusted throughout the run as our biggest presses do not have automatic viscosity control.
Ink

- Armstrong uses solvent based inks to print flooring. Use of solvent requires that presses and equipment used around them be intrinsically safe. Tools are air driven and electrical devices are completely sealed to prevent solvent fumes from entering and causing a spark.
- All ink colors are pattern and cylinder specific. Inks are mixed using 3 of 4 base pigments. Pigments are black, blue, red and yellow.
- Our largest press requires a minimum of 300 lbs. to fill the ink pans. This a lot of ink which is stored at the end of the print run. Storage of ink drums is a continuous challenge as they have to be stored in explosion proof rooms which are very expensive to maintain.

Color and Lighting Control

- Armstrong’s flooring division uses D50 (5000K daylight balance) as our viewing and illuminant standards. Our plants and our design department have controlled viewing rooms for proofing at press and evaluating product colors.
- This lighting standard, while critical for maintaining product color standards, is not the only light source we use for evaluation of color.
- Because of products can be viewed under many different lighting conditions from store lighting to home lighting, we have to be aware of how the color appears under these lighting conditions.
This is our end result.