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SELECTING A GYPSUM BOARD MARKING SYSTEM: THREE CRITICAL FACTORS FOR MANUFACTURERS

INTRODUCTION

Gypsum board, for both interior and exterior construction, comes in a variety of formulations, thicknesses, sizes and types. Principally made of a gypsum plaster mixed with additives and sandwiched between a top and bottom layer of paper, it can also be referred to as drywall, plasterboard, wallboard, sheetrock, LAGYP, gyprock or gib board. Standard thicknesses range from 0.25 to 0.75 inches, with the 4 x 8-foot outer dimension being the most common.

A single manufacturer typically produces many different gypsum board formulations on the same production line in up to 30 different plant locations. These might include:

- **Type X**, with additives that increase gypsum's natural fire resistance.
- **Greenboard**, with an oil-based additive in a green paper covering for moisture resistance.
- **Blueboard**, covered with a special blue paper that bonds to a plaster finish to resist water and mold.
- **Fiberglass board**, sheathing for exteriors that is later covered by siding, brick or stone.

Building codes throughout the United States and Canada require all types of gypsum board to be manufactured to the *ASTM C1396: Standard Specification for Gypsum Board*. This standard further mandates that all panels be legibly marked in accordance with *ASTM C1264: Standard Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping Handling and Storage of Gypsum Panel Products*. The specification requires variable information—including the manufacturer's name, facility location, production line, date and time of manufacture, and country of manufacture—to be printed on the paper backing of the gypsum board, parallel to the bound (long) edge.

Gypsum board paper backing must also be marked to confirm the product meets certain fire resistance standards set by Underwriters Laboratories (UL) Inc. A clearly printed UL Classified logo mark contains the UL symbol in a circle and the word

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“CLASSIFIED” in an arc above it. Under the mark is required verbiage that explains the product’s classification and refers back to the UL-published *Fire Resistance Directory*. At the end of production—during a quality inspection—an independent inspector must certify the legibility and completeness of the required markings. Products that do not pass inspection must be scrapped.

Today’s gypsum board manufacturers wish to differentiate and visually identify their products at home improvement retail stores and job sites. Others have partnered with retailers to private-label certain gypsum board products. Because of this trend, imprinting of graphic logos, brands, TrueType fonts and messaging on the paper backing has become more common. Further, some manufacturers mark a special grid pattern on the front paper (paintable side) of their gypsum board product, indicating screw placement as a value-added time saver for installers. For production efficiency, the best time to imprint these fixed marks is at the beginning of the production process. That is, at the same time the variable information is marked on the paper backing.

For the past decade, the most prevalent marking technology for printing the variable data on gypsum board backing paper—and for imprinting nail grid marks on the front of the board —has been inkjet printing. While these systems are well suited to the unique challenges associated with gypsum board manufacturing (excessive fine gypsum dust, material differences in target substrates ranging from paper to fiberglass, and production line vibrations), they are limited in their ability to create high-quality graphics. That’s due to limitations in their output resolution.

The ideal marking system must be able to print high-quality variable information and crisp fixed graphics, successfully interface with production equipment, and support frequent and multiple changeovers with automatic data management. Further, the system should easily accommodate extremely fast production speeds and be easy to maintain.

This white paper is intended to help gypsum board manufacturers identify and understand the key features to consider when evaluating marking systems for gypsum board printing.

THREE KEY AREAS TO CONSIDER WHEN EVALUATING MARKING SYSTEMS FOR GYPSUM BOARD PRINTING

The ideal printing solution for marking gypsum board includes a combination of two print technologies: DOD valve inkjet print heads and high-resolution industrial inkjet print heads, driven by a universal print management platform.

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Drop on Demand (DOD) valve technology utilizes a pressurized ink supply and electromechanical valves, which are signaled to independently open and shut to produce intermittent ink drops. As the product passes the print head, these droplets create dot columns which form characters or graphics. One type of high-resolution print head, thermal inkjet, employs tiny, electrically heated resistors that vaporize the ink, causing an air bubble to form. As the bubble expands, it forces a drop of ink onto the printing target. The second type of high-resolution inkjet printer employs a piezoelectric process that uses an electric charge to vibrate a piezo crystal in the ink feed nozzle, forcing out the ink. The attributes of each technology complement each other to directly address the numerous challenges faced throughout the gypsum board manufacturing industry.

Graphic Requirements

In order to produce the most legibly printed information and graphics on both front (paintable side) and back of gypsum board, it's important that a marking solution have features that can accommodate the following graphic requirements.

- **Text:** For applications that require variable, text-based imprinting of information, valve-based DOD inkjet print heads are a good solution. Control software directs the print head to apply the appropriate number of droplets per ink dot at resolutions from 7 to 32 dots per print head, producing maximum image heights from 1.25 to 5 inches. That translates into approximately 4 lines of text.
- **Images:** For applications that require repeatable imprinting of high-quality logos, fonts, images and graphics, the ideal solution is a high-resolution print head capable of creating a 4-inch-tall image, or approximately 50 lines of text (768 dots). The higher a print head's resolution, the better the quality of the graphics it can produce—particularly those incorporating curves, angles, shades or screens and other fine details. For gypsum board manufacturers the ideal high-resolution printer imprints crisp graphics or fine print at production speeds up to 600 feet-per-minute. These production speeds are achieved by reducing the print density of the graphics.
- **Static and/or variable messaging:** For applications that require imprints of both variable tracking information and repeatable, static, high-quality graphics and images, a printing solution that combines both DOD and high-resolution print heads is ideal. The DOD print head easily handles frequently changing text at output speeds and resolutions that are highly legible; the high-resolution print head generates required logos, brands, graphics and UL Classified or other regulatory marks in consistent, high quality.

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- **Size of graphics:** Depending on the speed of the production operation, print heads can produce legible marks that are limited in height. To accommodate multiple sizes of potential target images, or variable amounts of verbiage that needs to be imprinted on the gypsum board, look for print heads that can produce images range from 3 to 127 millimeters (0.125 to 5 inches). For creation of even larger images, groups of DOD print heads can be grouped together.
- **Mark location:** Most in-line printing and coding systems in the market are limited to a marking area of 4-inches in depth along the edge of the target print substrate (such as paper, in the case of gypsum board manufacturing). That's because the ink supply must be connected directly to the print head. Newer technologies incorporate either a gravitational or pump-feed system that actively delivers the ink from its storage tank to the print head via a supply tube in excess of 2 feet long. This extends the available print area into the middle of a standard 4-foot-wide gypsum board span. Adding a printer system—with one or more print heads to create stitched images—to both sides of a production line can enable full coverage of the printing substrate for maximum graphic impact.
- **Mark quality:** Due to UL Classified fire resistance requirements, and the expectations of retailers who demand high-quality impressions of their own brand graphics, it is critical that the printing system be able to product crisp images. Look for an in-line, high-resolution print head capable of running at speeds from 200 to 600 feet-per-minute in order to ensure consistent, repeatable and pristine graphics.

Printing Equipment Features

To handle the unique demands of gypsum board production, manufacturers should look for printing equipment features that flexibly accommodate these requirements.

- **Resolution:** To produce two very different types of information on the same piece of gypsum board—variable, text-based tracking information and crisp, high-quality brand marks and images—the ideal solution combines two different types of print heads. A DOD printer with resolutions from 7 to 32 dots per print head, producing maximum image heights from 1.25 to 5 inches, can be used to imprint the variable text. A high-resolution print head is better suited to imprint graphics. Look for a system that can integrate and manage both print head technologies as a unified, cohesive solution.
- **Output speed:** With gypsum board manufacturing production lines typically running at rates from 200 to 600 feet per minute, it is important to select print heads that can keep up with that pace. Look for DOD systems that output at

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maximum speeds ranging from 400 to 780 feet-per-minute, and high-resolution systems that print at speeds up to 600 feet-per-minute.

- **Image size:** A gypsum board manufacturer's maximum imprint size should not be limited by the maximum capacities of a single print head. Rather, it should be incrementally expandable by the ability to group, or gang, multiple print heads together as one unit and control them with a powerful print management controller. The ideal system can group up to 32 high-resolution or DOD print heads to seamlessly stitch large-scale images.
- **Ink formulation:** Particularly for manufacturers printing grid marks on the front of their gypsum board as a value-added benefit for installers, make sure that the inks used by the printing system are specially formulated to not bleed through when painted over. Also, because of the high-rate of production speeds, it's important to select solvent-based inks that dry on contact—that is, are absorbed immediately by the porous paper or fiberglass substrate upon application—regardless of which side of the gypsum board or which printing system applies them. To mark gypsum board destined for exterior use, look for printers that can run inks formulated for stability that resist fading when exposed to ultra violet (UV) light. Additionally, to meet the U.S. Environmental Protection Agency's (EPA's) restrictions on the use of volatile organic compounds (VOCs) in manufacturing facilities, look for an ink supplier who can provide pigmented and water-based ink formulations that will satisfy these requirements.
- **Ink density control:** To produce graphics with varying tones, or shades, within the image—such as a gray-scale photo effect—look for DOD and high-resolution printers whose dot output density can be variably controlled for the greatest flexibility in printing a variety of images and text.
- **Installation flexibility:** Where the printers are physically located on a web press or within a production facility may be limited to the areas that are most accessible for ink tank refilling, control panel monitoring or routine maintenance activities. Look for units that can be installed in a variety of ways, including via custom mountings, such as, conduit hanging brackets or unistruts, din-rail mounting hardware, swivel mounts and more. The ideal marking system supplier will be able to provide custom integration services to ensure a smooth installation.
- **Print head orientation:** The ideal printer installation may require a print head that can be oriented to print in more than one direction or angle to accommodate the angle of the web printing operation. Consider DOD print heads that can print at any angle in a full 360-degree circle. The ideal high-

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resolution print heads can be angled 180 degrees to print from the top down, at a 90-degree right angle, or from the side. This enables the bi-directional high-resolution print head to print at a horizontal orientation (on a substrate running vertically), at a vertical orientation (on a substrate running horizontally).

- **Maintenance requirements:** Production processes at some gypsum manufacturing plants require frequent replacement of ink bottles to ensure that their print heads do not run out of ink mid-production run. The ideal system can be equipped with large capacity ink supply tanks, up to 5 gallons, to provide longer run times and reduce the frequency of manual intervention required to refill ink supplies. Further, both DOD and high-resolution print heads themselves require minimal maintenance; look for print heads that include an automatic cleaning system to maintain pristine print quality and minimize ink consumption. Maintenance for DOD print heads is minimal, seldom requiring more than a periodic flush, a simple routine triggered from the printer's human machine interface (HMI). This periodic flushing eliminates potential valve clogs, which may occur from dust or debris accumulating in the print head nozzles. Clogged valves may result in a line appearing through the message, or a row of dots to be missing from the print, impacting the legibility of the text or symbol. Poor legibility of a UL classified logo may be unacceptable to quality inspectors.
- **Vibration tolerance:** Printing equipment that can handle the vibrations produced by all the equipment on a gypsum board production line, running at speeds up to 600 feet-per-minute, is a must. Look for rugged print heads that are engineered and constructed to stand up to continuous, low-grade shaking common to web-based printing applications.
- **Challenging environment:** Due to the innate nature of gypsum board production, contaminants are prevalent. Dust and fibers from the materials used in its manufacture—including gypsum, paper and fiberglass substrates—as well as heat and moisture from the manufacturing process, will be present on the production line. Therefore, the ideal print heads for gypsum board manufacturers are those engineered to withstand rigorous, challenging conditions. Look for print heads equipped with non-clogging, self-cleaning valves and ingress protection ratings of IP65 (the "6" indicates complete protection against dust, the "5" indicating protection against low pressure water jets from all directions, making it impervious to condensation or wash-downs.)

Printer Management System

To provide better customer service and remain compliant with industry standards, gypsum board manufacturers will benefit from a print controller that easily accommodates the following challenges:

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- **Control of multiple print technologies:** To leverage the advantages of a system that utilizes one or more print technologies, such as DOD and high-resolution print heads, it is key to implement a universal print management system. The ideal system utilizes a single, centralized controller to manage multiple devices across multiple production lines, populate production information into templates maintained in a centralized database, interface with new or existing databases, and operate a multitude of print technologies from a variety of manufacturers.
- **Production changeovers:** Very few print controllers have the ability to drive multiple print heads, spanning multiple production lines, from a single source. That means every printer on every production line has to be changed over manually to accommodate the next product's manufacturing run. To verify the correct imprinting, a certain amount of scrap is produced. The ideal control solution easily accommodates frequent product changeovers and populates all line-side printing systems with the correct imprint information automatically to minimize scrap.
- **Information changes:** Labor is required to modify locally stored mark information every time an edit is made. Development of new templates that look consistent from one production location to another is a challenge. The ideal print control system is, therefore, one that communicates imprint design modifications to every print technology universally, including DOD and high-resolution print heads, without human intervention. The ability to maintain a centralized database of imprinting information that communicates automatically with all production lines, regardless of manufacturing location, yields tremendous cost savings.
- **Consistency from location to location:** Because most manufacturers operate anywhere from 10 to 30 different production facilities, maintaining consistency of imprinted information can be difficult; particularly when each printing system is updated manually. The ideal print controller eliminates this inconsistency by interfacing with and controlling every printer, regardless of physical location, to direct its output.
- **Imprint production cost:** How much does it cost to produce a two-inch tall graphic versus a three-inch tall graphic? Is it more or less expensive to print the vertical orientation of a logo versus its horizontal orientation? Which font requires the least amount of ink? Currently, the only way to answer these questions is to observe how quickly an ink tank empties during a production run. Therefore, the ideal printer management system can analyze a graphic and calculate the cost to produce the mark in terms of the amount of ink required or

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the print head used to print it. The ability to simulate production runs and compare image options via the print management system yields tremendous cost savings.

Conclusion

Now available: All these key features critical to manufacturers seeking high-quality printing on gypsum board is delivered by the **MPERIA™**. The complete package, from Matthews Marking Systems, includes the Viajet™ V-Series large character drop-on-demand (DOD) print head and the high-resolution Viajet™ T100S print head, both controlled by the MPERIA™ universal print platform. Matthews' service team will provide installation support to ensure a seamless integration with your existing production line. Matthews also has the ability to provide Custom Solutions including logo and kick plates, custom mounting, traversing systems and specialized software.

The **Viajet™ V-Series** large character DOD print head features reliable valve technology to mark on porous and non-porous substrates, including paper and pulp, wood, plastic, concrete and metal. Its large character print output ranges from 3 to 127 millimeters (0.125 to 5 inches), and can be expanded by grouping multiple print heads to produce stitched images at unlimited sizes. Ideal for variable data marking coding of products for traceability purposes, the unit uses specially formulated pigmented inks that dry on contact.

The **Viajet™ T100S** high-resolution print head prints directly onto porous paper surfaces and can be tilted 180 degrees to print from the top down, at a 90-degree right angle, or from the side. The print head produces high-resolution certification marks, barcodes, text, logos and other graphics at image heights up to 4 inches per head. Multiple heads can be grouped together to produce stitched images at unlimited sizes. To make accessing space-restricted production areas easier, and to extend the accessible print area, the T100S is equipped with a 27.5-inch flexible umbilical ink feed tube that connects the print head to the ink tank. It utilizes specially formulated, highly pigmented inks that dry on contact.

MPERIA™, allows users to control multiple production lines, integrate order processing, populate production data from order processing files, and interface with new or existing databases—all from a single, centralized controller. It integrates easily with enterprise resource planning (ERP), manufacturing resource planning (MRP) and warehouse management system (WMS) databases to reduce coding errors and efficiently manage and coordinate multiple printers simultaneously. This universal print system features an intuitive, touch screen controller interface with built-in image editor to make message creation and selection simple.

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Visit **www.matthewsmarking.com/MPERIA** to learn more about this unique system and to schedule your in-facility demonstration today.

About Matthews Marking Systems

Matthews Marking Systems, a member of Matthews International Corporation, provides product identification, branding and traceability solutions. With more than 160 years of experience, Matthews offers a full line of quality high-resolution, continuous ink jet, laser, drop-on-demand, thermal transfer, contact and indenting technologies. For more information on Matthews' products and services, contact Lyndsey Farrow, Matthews Marking Systems, 6515 Penn Avenue, Pittsburgh, PA 15206. Telephone (412) 665-2536, fax (412) 665-2550, www.matthewsmarking.com.

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