STORM POWER COMPONENTS

Applications Note

Understanding Part Marking Options & Best Practices

In many cases, busbars need to include markings for serial numbers, part numbers and/or safety information (phase colors, manufacturer, polarity, etc.). Different part marking techniques vary in terms of cost, durability and suitability for coated or uncoated bars.

This App Note provides an overview of marking methodologies along with a discussion of tradeoffs and key considerations for choosing the best fit for particular busbar designs and applications.

Some key considerations when choosing a Direct Part Marking (DPM) method for busbars include:

Consider the finish and environment.
Bare or plated copper or aluminum bars can be marked by laser engraving, machined engraving or vibro-etch.

Balance durability against cost.
Permanent identification (e.g., serial numbers on safety-critical busbars) justifies high-durability methods such as laser marking, etching, or specialty labels. For temporary identification or low-risk components, lower-cost methods such as direct digital printing, rubber stamping, or labels may suffice. Machined engraving offers deep marks but requires machining time and may not be justified for every part.

Account for thickness and structural integrity.
Impression stamping and dot-peening can deform thin aluminum bars or ghosting may appear on the reverse side of thin aluminum parts. For thin or delicate busbars, laser marking or adhesive labels may be more appropriate.

Assess graphics requirements.
For simple text or serial numbers, etching, labels, laser engraving or rubber stamping may be sufficient. For multi-color logos or detailed graphics, labels, digital printing or silkscreen offer better results. Digital printing handles complex images, while silkscreen provides high-contrast single or multiple colors.

Industry and regulatory requirements.
Defense and aerospace applications often require compliance with military specifications. Mil-Spec labels are available. Dot-peening, laser marking, machined engraving and rubber stamping are recognized as acceptable permanent methods. For busbars used in critical systems, choose methods that meet these standards.

The following sections provide deeper information on the specific part marking methods available from Storm Power, and a closer look at the tradeoffs.

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Storm Power's Part Marking Alternatives

Rubber Stamping:
Using number/letter stamps and permanent ink, this is a relatively simple process for part marking, which can be used on virtually any busbar surface that has a smooth surface. Once the stamp has been created, the marking process is fast and low-cost to apply.

Limitations of rubber stamps include lack of high precision, and limits on font size depending on the stamp's surface area.

Rubber stamping can offer a simple and quick method for serialization and traceability, where the ink sits on the surface and does not damage the underlying busbar material.

Adhesive Labels:
Another low-cost marking method is to use standard paper or polyester labels, which are available in many different sizes. Printed labels provide quick identification that is easy to apply on the part or packaging. Labels can include logos or barcodes (including QR Code or Data Matrix) and can be temporary or permanent.

Labels can be selected for temperature, chemical resistance and military compliance.

Direct Digital Printing:
This is another relatively low-cost marking method that uses ink-jets to print directly on to the parts. Ink-jet printers use non-contact print-heads.

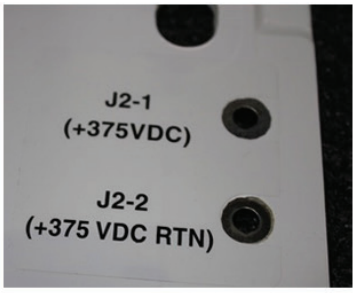
Limitations: Because the ink sits on the surface and has a slightly raised texture, marks can wear over time.

Direct printing is good for busbars or covers when detailed marking is required, but are not ideal for surfaces that will be handled heavily or where a permanent mark is needed.

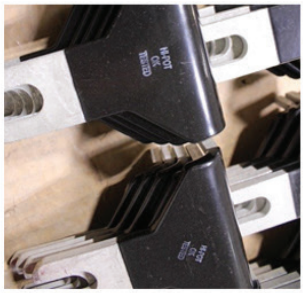
Laser Engraving:
Laser engraving offers superior precision for fine details, durability that resists wear and fading, speed for high-volume production, and versatility across many materials. It is ideal for precision application such a barcodes or other fine-pitch text and images.

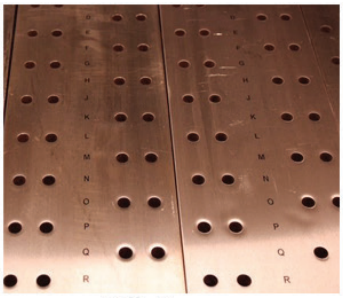
Unlike methods like printing, inkjet, or dot-peen marking, the laser-created mark is permanent and resistant to abrasion and chemicals, making it ideal for demanding industrial applications requiring long-term traceability.

Laser Engrave



Label


Rubber Stamp


Silk Screen

Storm Power's Part Marking Alternatives (continued)

Vibrating Stencil Marking:
This vibrating "dot engrave" process creates a pattern of discrete dots that form characters or designs directly etched on to the busbars. It is able to rapidly produce permanent markings with high precision and clear text.

Limitations include the potential for pixelated appearance and/or ghosting that may appear on the reverse side with very thin materials.

The process is suitable for serial numbers and 2D codes; recommended in MIL-STD-130. It has the flexibility to provide permanent identification of busbars before or after powder coating, which is helpful when deep markings that remain visible after coating are required (e.g., serial numbers on copper or aluminum bars).

Silk Screening:
Uses a mesh stencil and epoxy-based inks to apply graphics on uncoated or powder coated parts. Storm Power uses durable epoxy inks and stocks standard colors. Silk screening can provide high-contrast marking, especially on smooth finishes.

Limitations include the cost and time for creating a screen, which can make it not cost-effective for small runs or for frequent design changes. Because the process is limited to a single-color per screen; multi-color designs need multiple passes.

Silk screening creates crisp, high-contrast, single-color images; works on bare metal or insulated parts and is suitable for logos, labeling and decorative elements. Using epoxy inks provides resistance against wear and solvents. It is suitable for large flat busbar surfaces when a high-contrast, durable graphic is needed (e.g., phase identification, company logo), but is less appropriate for very small text or variable data.

Dot Engrave

Laser Engrave

Label

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In summary, Storm Power has defined and optimized multiple options to meet a variety of part marking requirements for our customers.

This App Note should give you a foundation for guiding part marking choices that fit requirements for cost, tooling, cosmetics, durability, Mil-Spec requirements, etc.

For example, direct digital would provide low cost, with no tooling and fast, easy set-up, but is not suitable for Mil-Spec.

Or polyester labels also offer low cost, with two-color strip labels that can be auto-printed with fast, easy set-up and applicability for serial numbers, bar codes, data codes etc. For an additional cost, Mil-Spec labels can be used.

Silk screening delivers durable, crisp, single-color or multi-color markings that are ideal for larger production runs.

Rubber Stamp & Silk screen can use different inks that are Mil-Spec compliant, however they require tooling and some setup, rubber stamping isn't as cosmetically appealing but is used for simple markings, low quantities, or geometry that can't be silk screened.

Storm Power's integration of a wide range of part marking methods into our design and production processes is one of many ongoing initiatives that underscore our commitment to improving service to our customers with greater agility in design, faster responsiveness and low-cost, high-quality manufacturing results.