

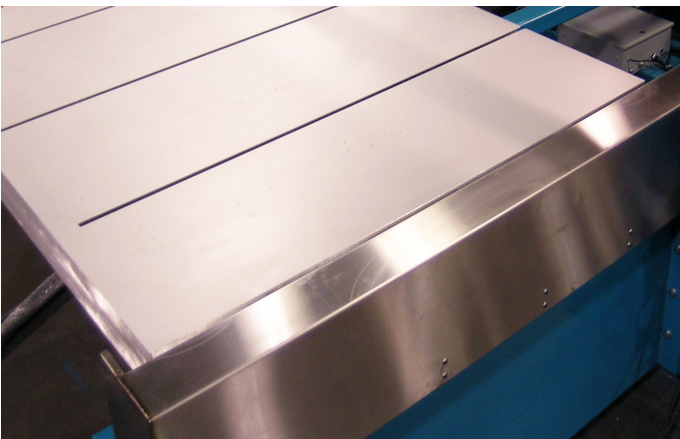
# SURVIVAL OF THE FLATTEST

Screen printers seeking ever-greater precision often neglect the most essential parameter of all

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Screen printing is a mature and dependable technology that continues to dominate numerous market sectors because of its simplicity, its reliability, and its adaptability across a wide range of applications. One of the ways that screen printing maintains its relevance for modern markets is through continuous technological evolution, particularly in improving the precision of the basic screen printing process, making it more consistent and cost-effective, and versatile in responding to customer demand.

Indeed, in recent years there has been a flurry of new developments and refinements to venerable screen printing tools in an effort to improve registration accuracy, process consistency, and image repeatability. Accordingly there have been impressive developments in techniques for controlling the variables in the screen printing process, including ultra-precise squeegee blade preparation, new ways to improve stroke pressure consistency, specialty meshes, meticulous screen tensioning, new ink formulations, and many others.



Vacuum tables with verifiable surface flatness facilitate better-quality screen printing results.

While these improvements to various discrete aspects of the printing process have certainly helped screen printers to achieve much higher-quality results and greater overall image consistency, in many cases the full benefits of these enhancements are not realized or optimized because of a simple failure to control the most fundamentally crucial of all screen printing parameters: the flatness of the surface on which the substrate is registered.

## FLATNESS FUNDAMENTALS

Flatness is a surface condition used in Geometric Dimensioning & Tolerancing (GD&T) to reference how flat a surface is regardless of any other datum or features. Flatness is distinct from, but often confused with, parallelism.

- Flatness is a surface condition; the 3D version of surface straightness
- Flatness is applied to an individual surface, the tolerance is not related to a datum
- Flatness is measured with a scanning probe on a Coordinate Measuring Machine (CMM)
- Flatness standards are 0.003" per inch in industrial settings, and 0.001" in scientific settings

Flatness measurement and certification is common in the concrete and stonework industries, where it is used for measuring flooring, sheathing, and countertops, but the standard tolerances in these industries are not as precise as those required in screen printing. In aerospace and high-tech applications, the surface plate is often used as the baseline for subsequent measurement; therefore it may be finished extremely flat, with even greater accuracy.

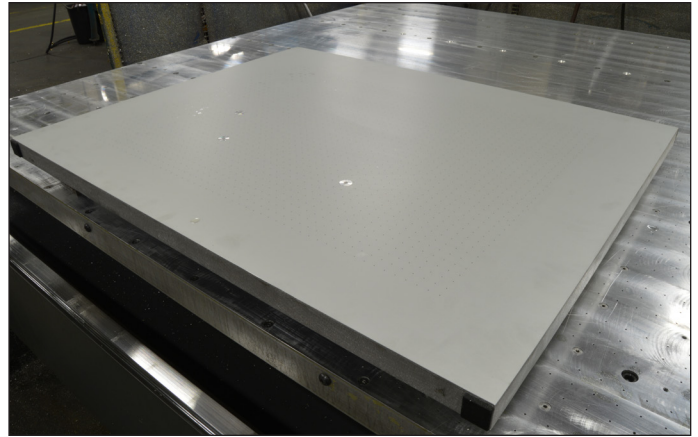
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# SURVIVAL OF THE FLATTEST

Without true, consistent, and reliable flatness at the work surface, all other attempts to increase screen printing precision will inevitably fall short, as surface flatness impacts every other aspect of the process. In fact, many printers who are unable to achieve high-quality results may be ignoring the root cause of their problems when they devote insufficient attention to surface flatness. To derive the full benefits of today's precision screen printing tools and techniques it is imperative to start at the beginning, with a verifiably flat and level printing surface, ideally a flatness-certified vacuum table.

## A stable foundation

Graphics screen printing presses and systems typically utilize a vacuum table work surface to register substrates and hold them in place for printing, which may require several passes for complex designs and images. Vacuum tables are more efficient and precise than using adhesives and facilitate the level of micro-registration that is necessary in modern production environments. Obviously the flatness of the vacuum table surface will have a significant impact on squeegee pressure



Any deflection from true flatness can impact pressure consistency and compromise image quality.

consistency and possible mesh movement and therefore will affect image quality.

The ease with which printers are able to maintain precise registration is one of the primary advantages of vacuum tables for screen printing and maintaining verifiably flatness is imperative if printers intend to maximize this advantage. Surface flatness allows the substrate to be registered in more than one

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## A BRIEF HISTORY OF FLATNESS

Measuring and controlling flatness became a priority for mechanical engineers at the start of the European Industrial Revolution, and it was in the 1830's that British engineer and inventor Joseph Whitworth developed the first widely accepted method for creating accurately flat surface plates.

Access to reliably flat surface plates in turn spawned the invention of precision measuring instruments and techniques and propelled the evolution of modern manufacturing processes.

- 1830's: Joseph Whitworth creates first accurately flat surface plates for industry
- 1850-1920: development of precision instrumentation using flatness as a reference
- 1950's: introduction of Coordinate Measuring Machines (CMMs)
- 1980's: incorporation of Flatness into Geometric Dimensioning and Tolerancing standards

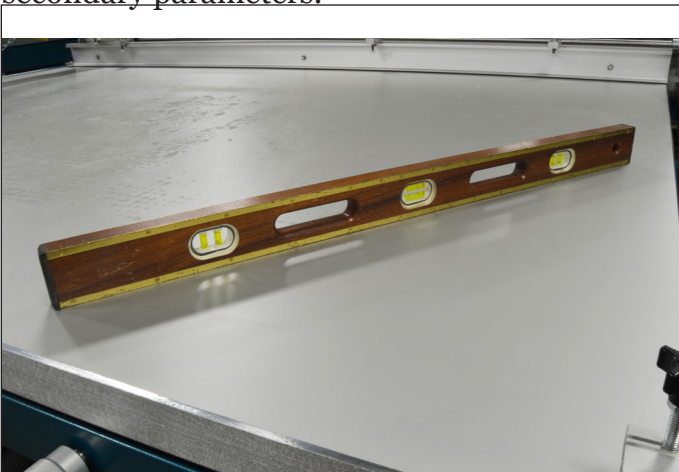
In many ways, flatness is the basic parameter that has fostered the development of modern industrial and mechanical engineering allowing production consistency and the achievement of ever-higher tolerances in manufacturing. Today, in medical, scientific, and aerospace settings, flatness can be measured even more accurately to facilitate even more sophisticated processes and techniques.

plane (i.e. horizontally and vertically) for greater accuracy but the surface must be flat and within appropriate tolerances for these advantages to be fully exploited. Any deflection from true flatness will result in a corresponding registration variance that will affect image quality.

Image repeatability is crucial for successful screen printing and verifiable surface flatness allows printers to achieve the even ink application and ink deposit thickness necessary to produce the quality and consistency that the market demands.

## The key to consistency

Beyond its importance for registration and image repeatability, surface flatness has vital ramifications for other aspects of the printing process and production quality. Even small variations in surface flatness can adversely affect pressure consistency and result in uneven ink deposits, compromising image quality and undermining the effectiveness of even the best equipment, accessories, and supplies. It really won't matter how sharp your squeegee blade is or how perfectly tensioned your mesh; if your work surface isn't truly flat you will be unable to realize the full advantages of controlling these secondary parameters.



Print surface flatness is the most important parameter for screen printers to control.

This is particularly important when dealing with backlit signs, electronic coatings, complex multi-color or fine line designs. In fact it is generally assumed that many imperfections in screen printing emanate from registration issues when they may actually be the result of uneven application of ink due to unsatisfactory print surface conditions. These effects are likely to be more pronounced when using more viscous inks. To properly execute these images with consistency in a production setting requires all operational parameters to be controlled and coordinated and here again it is impossible to over-emphasize the primary importance of print surface flatness.

At each juncture of the screen printing process, reliable work surface flatness allows the printer to realize the full potential from other tools and components and attain the highest-quality results.

## Flatness and the bottom line

With so much emphasis on precise image repeatability in the industry today, screen printers must be certain to control the single most important variable in their operation: the flatness of the surface on which their substrate is registered for printing. Without verifiable and reliable flatness, all other parameters in the production process may be skewed, and the source of the problem may not be immediately apparent.

Surface flatness facilitates even application of inks, ensuring image repeatability and boosting production efficiency. Verifiable flatness also creates the correct conditions for the use of a range of modern screen printing tools and techniques designed to enhance quality and consistency.

The fundamental parameter that underlies all other production variables, true surface flatness represents the starting point

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for modern, high-quality screen printing operations and offers an opportunity for savvy printers to distinguish themselves from the competition and increase sales. For screen printers looking to grow into the future, it's a matter of survival of the flattest.



Since vacuum table certification ensures flatness within specific tolerances across the entire surface, every printer should request a Certified Flatness Report from their vacuum table manufacturer.

## STATE-OF-THE-ART VACUUM TABLES FROM G.P.I. ARE CERTIFIED FOR FLATNESS

The upsurge in interest in precise control of all aspects of screen printing operations has created an industry-wide demand for high-quality work surfaces that can be relied upon for flatness, smoothness, and resilience, even in sometimes harsh production environments.

Vacuum tables from Graphic Parts International, Inc. are certified for flatness and available in a wide variety of configurations to suit any screen printing application. All-aluminum construction and a unique sandwich design yield a superior strength-to-weight ratio, and the thickest top and bottom plates in the industry ensure outstanding durability.

G.P.I. is the first vacuum table manufacturer to provide flatness inspection reports. Each customer receives a report with every vacuum table produced. Each table is thoroughly inspected and certified for flatness across its entire surface by production technicians and engineers prior to shipping.

- Certified flatness across entire surface
- Manufactured to your specifications
- Non-warping, Stay-Flat™ technology
- Meet or exceed OEM standards
- Uniform airflow from edge to edge
- Rust free, non-oxidizing, anti-static

Available options include disappearing registration guides, threaded inserts, custom cutouts, and lift pins. Custom surface materials include stainless steel, anodized aluminum, phenolic, Formica, and enameled-core magnetic steel.

Built to individual specifications, vacuum tables from VacuumTables.com and Graphic Parts International meet or exceed OEM requirements for smoothness, flatness, and production endurance.