
Screen Printing Terms and Definitions

GENERAL

CYCLE TIME: The total elapsed time from board entrance to board exit of the machine, including transport, board to stencil alignment, print cycle, auto paste dispensing if applicable, and auto stencil wipe if applicable. The following characteristics influence cycle time:

- Board Size (controlling print stroke)
- Squeegee Speed
- Board/Foil Separation Speed
- Stencil Wipe Speed and Frequency (when applicable)
- Paste Dispensing Frequency (when applicable)

When stating cycle time each element should be listed separately with its individual cycle time. Total cycle time should be represented from event to event. For example the elapsed time between the leading edge of board #1 hitting the conveyor exit sensor and the leading edge of board #2 hitting the exit sensor.

BOARD SIZE: The outside dimensions of the board. The dimensions should be defined with the length of the board first and the dimension which controls the conveyor width second. (L x W)

PRINT AREA: The area in which the pattern to be printed is within. (L x W)

FRAME SIZE: The outside, inside, and thickness/depth dimensions of the stencil/screen frame. (L x W x D)

FRAME: The structure which supports the stencil/screen. This can be either cast or tubular Cast frame sizes are referenced from the inside. Tubular frame sizes are referenced from the outside.

FOIL: The metal area of the stencil which contains the print pattern.

FLEX MASK: The flexible polyester material which attaches the foil to the frame. If it exists there should be a minimum of 1.00" to 1.25" of flex mask between the foil and the frame. The flex mask attachment to the foil should be a minimum of 1/2 inch.

FRAMELESS STENCIL: A metal foil which is not permanently attached to a frame. During use they are stretched into a frame and do not have flex mask. When not in use they are in a metal foil only, state.

FRAME ADAPTER PLATE: An adjustable frame which allows numerous frame sizes to be used in the machine or can be dedicated to any frame size allowing a frame which is different from the machines standard chase size to be run in the machine.

BOARD STRETCH: A difference in dimension between one feature on the board and another from the original artwork or from board-to-board. This can also be referenced to the stencil.

SCREEN/STENCIL STRETCH: A difference in dimension between one feature in the stencil/screen and another from the original artwork or the stencil.

MACHINE ACCURACY: The ability of the machine to align the board to the stencil and the difference between perfectly aligned and the actual. This can also be defined as the tolerance of a movement.

REPEATABILITY: The variation in the alignment of the board and stencil between one cycle and another. A statistically significant sample of cycles is 30.

RESOLUTION: The minimum distance increment that a system can obtain when moving a specific axis.

X AXIS: The axis direction left and right in relation to the front of the machine. The left being negative X and the right being positive X.

Y AXIS: The axis direction which is from front to back on the machine. Into the machine the machine being positive Y and out of the machine being negative Y.

THETA AXIS: The axis direction rotating around the center of the machine clockwise and counterclockwise from the perspective of above the machine looking down. Clockwise is positive theta and counterclockwise in negative theta.

SERVICE: The electricity and air requirements for the machine. Electricity beina defined by voltage, amperage, phase, and frequency. Air requirements being defined by PSI and cubic feet per minute (CFM). Vacuum is defined by in./mercury or cm./mercury.

ALIGNMENT CAPABILITY INDEX (Cp): A measurement used in six sigma statistical measurement which provides a scale for machine repeatability capability comparison. Cp is defined by the following formula:

$$Cp = \frac{UsL - LsL}{6 \times (\text{Std. Dev.})} = 2$$

Standard six sigma principles state that in order to have six sigma capability this formula must equal 2 or greater. The theory being that the machine should be twice as good as the process specification. In the above formula the Upper Specification Limit (UsL) should be +0.001 and the Lower Specification Limit (LsL) should be -0.001. These are limits set to define what is a rejectable product. Standard deviation data should be collected by a measurement system which is external to the machine to ensure that the true capability of the machine is calculated with a statistically sound method.

ACCESSORIES

PASTE CARTRIDGE: A plastic syringe holding for example 300-350 or 600-700 drams of solder paste. The cartridge should be 1.650" O.D. and have a 3/4" O.D. nossle on the bottom with 1/2-20 threading in the inside of the nossle. The 600-700 gram cartridge should be 7 inches long. The 300-350 gram cartridge should be 3.75 inches long. 1200 gram cartridges are also available and should be 12 inches long.

D CUT SQUEEGEE: A single diamond edge squeegee which is shaped like an upside down house and made of polyurethane.

FOUR-SIDED DIAMOND EDGE SQUEEGEE: A polyurethane 3/8 x 3/8 four sided, four edged squeegee. The diamond corners are used as the printing edges.

METAL SQUEEGEE: Thin metal blades that are mounted at a trailing edge angle in relation to the stencil.

TRAILING EDGE SQUEEGEE: Any squeegee mounted at an angle such that the printing edge of the squeegee trails behind the print head and the face of the squeegee slopes forward.

PRINT PARAMETERS:

SQUEEGEE SPEED: The velocity at which the squeegee traverses across the stencil/screen.

PRINT STROKE: The distance the squeegee travels across the stencil/ screen during printing while under pressure.

SQUEEGEE HOPOVER: Used with a single squeegee, hopover is the action the squeegee takes after lifting off the stencil/screen upon completion of the print stroke. After lifting off the stencil/screen and above the solder paste which was pushed by the squeegee during the print stroke, the squeegee continues in the direction of the print

stroke until it is past the roll of solder paste. When the squeegee goes down for the next stroke it can then push the roll of solder paste in the other direction. The hopover is defined by the distance the squeegee moves in reverse of the upcoming print stroke.

SQUEEGEE PRESSURE: The total force with which the squeegee head pushes down onto the board.

SQUEEGEE DOWNSTOP: The distance that the squeegee head moves down after the squeegee has contacted the top surface of the board.

SNAP-OFF: The distance from the top surface of the board to the bottom surface of the stencil/screen. Zero snap-off is defined as on contact printing. Having any amount of snap-off present during printing is defined as off contact printing. Having the board move into the stencil is negative snap-off.

ANGLE OF ATTACK: The angle of the squeegee in relation to the stencil or screen from the perspective of the forward direction surface of the squeegee blade.

SQUEEGEE DUROMETER: The measurement of hardness of squeegee material using the Shore A scale.

TRANSPORT SYSTEM

TRANSPORT SPEED: The velocity at which the board moves while on the conveyor system of the machine. The conveyor system can include belts, chain, shuttles, walking beam etc.

BOTTOM SIDE CLEARANCE: The distance from the bottom surface of the board to the feature with the maximum height within the board transport route. Bottom side clearance should be a minimum of 1/2 inch.

BOARD EDGE CLEARANCE: The zones on the bottom surface of the board along the transport tracks which must be clear of all components. The minimum requirement is 0.188" (4.78 mm).

WORK NEST: The area in the machine which supports the board during printing.

SUPPORT PINS: Moveable pins which contact the bottom of the board and supply support for the board during printing

SUPPORT BRIDGES: Flat supports which take up large support areas on the board during printing.

DEDICATED WORKHOLDER: A flat plate which mounts in the worknest area to enable customized board support during printing.

BOARD STOP: A mechanism which locates the board in the work nest prior to alignment with the stencil.

MECHANICAL BOARD HOLDERS: Clamping mechanisms to hold the board on the worknest or workholder during, printing. Used to augment vacuum hold down or can be used as the sole hold down method to allow for printing without vacuum.

AUTO TOOLING: A system within the printer which allows for the automatic placement of support for the board.

VISION SYSTEM

VIEWING CAPABILITY: The area which the vision system can move within in the X and Y direction to view fiducial locations.

FIELD OF VIEW: The area the camera can view when stationary.

TEACH WINDOW: The area which can enclose a fiducial or target during the vision teach procedure.

FIDUCIAL: The feature used for aligning the board with the stencil. Stencil/screen printers should be able to use pads or SNMMA standard fiducials. (see SMEMA Standard 3.1 for fiducial specifications).

POST PRINT INSPECTION: Inspection of the board after printing by a system which may be internal or external to the stencil/screen printer. Possible system measurement capabilities are; paste registration, paste height, percentage of paste coverage, and paste volume.

MANUAL VISION SYSTEM: A vision system which requires manual axis adjustment after viewing.

AUTOMATIC VISION SYSTEM: A vision system which is integrated with automatic axis adjustment during and/or after viewing.

PROCESS CHARACTERISTICS

PITCH: Defined as the center-to-center distance between pads.

FINE PITCH: Any part or pad geometry which has a pitch equal to or less than 0.031" (0.7 mm).

ULTRA FINE PITCH: Any part or pad geometry which has a pitch equal to or less than 0.016" (0.4 mm).

PASTE HEIGHT: The distance from the pad surface on the board to the top of the printed solder paste.

DOG EARS: A paste print definition characteristic where the edges of the printed pad are pulled up by the stencil.

SCOOPING: A paste print definition characteristic where the edges of the printed pad are equal in height to the thickness of the stencil, and the middle of the pad has been pulled (scooped) out by the squeegee. A similar defect is where the printed paste height is equal to the stencil thickness on the leading edge of the pad and then decreases monotonically in the direction of the print. A defect that shows the characteristics of this but in the opposite direction, results in the paste being lower on the leading edge and equivalent to the stencil thickness on the trailing edge.

BRIDGING: An excess amount of solder paste so as to cause the printed pads to run together and touch each other.

VOIDS: The condition of having less paste than desired or having no paste at all on a given pad.

About SMEMA

The Surface Mount Equipment Manufacturers Association (SMEMA) is a non-profit organization of companies manufacturing equipment or producing software for surface mount board production. Its objectives are to: promote standards for the interface and operation of equipment, provide users with the ability to select equipment with the assurance that the equipment will interface easily, advance SMT and promote its use, and investigate areas where the association can act to the benefit of all member companies.

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