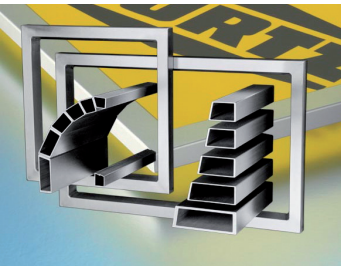


Frames and tensioning systems for SMD stencils

Production process of SMD stencils in frames

Overview

The vast majority of today's SMD-technology stencils are mounted inside a stencil frame. Different types of frames such as: light aluminium, cast aluminium, and stainless steel are available. Cast aluminium is used exclusively when a very high-mesh tension is required and high tensile strengths are necessary. The screen or stencil printing machine usually determines the frame size requirement. Customers can request a host of frame sizes, with a maximum working area of 600 mm x 800 mm (23.62 x 31.50 inch). LaserJob keeps a large stock of frames, oriented toward our customer's demands, in order to react in a fast and efficient manner. And a customer can inquire, at any time, as to the current warehouse stock. In recent years, tensioning systems have become quite common, each with their own unique support fixtures and perforations. The tensioning systems were developed as a cost-saving and storage-space reducing alternative to frame-mounted stencils. Framed stencils are characterised by their high durability, stable handling and high tensile strength in comparison to tensioning systems. Also, because of their fragility and required tolerances, stencils with low material thicknesses [$\leq 100 \mu\text{m}$ (4 mil)] are typically produced in a stencil frame.



Picture 1: Slope-Profiles

Picture 2: Anodized frames

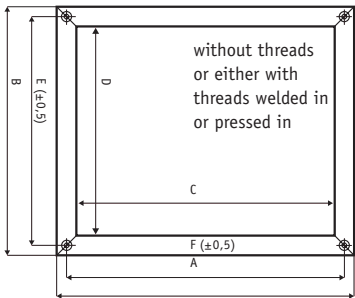
Standard aluminium frames

The standard aluminium frame profile is well established in the electronic production industry. Depending on the application (and on the size of the stencil printer) multiple frames and profiles are utilized. An overview is given in table/view 1. Aluminum frames are characterized by stable and robust production handling requirements. The shelf life is extremely good and, the frames can be used several times over many years. The stainless steel material is bonded to the frame under high tension, eliminating the risk of buckling. The aluminium frame is extremely strong and non-pliable, allowing tensioning forces above 40N/mm^2 . If a higher aluminium frame stability is required, frames with „Slope“ profiles can be implemented (see picture 1). Based on these profiles, higher mesh tensions can be obtained. To distinguish between RoHS-conform and standard products, color-marked frames can be provided. Working in conjunction with their key supplier, Laserjob developed a green-anodized color, which shows a high resistance and compatibility with most cleaning agents (see picture 2).

Advantages

- stable handling
- longevity and durability
- high tensile strength
- low net weight

| Outside dimensions (mm, A x B) | Internal dimensions (mm, C x D) | Profile (mm) |
|-----------------------------------|------------------------------------|-----------------|
| 736 x 736 29" x 29" | 656 x 656 | 40 x 40 |
| 400 x 300 | 340 x 240 | 30 x 30 |
| 650 x 680 | 590 x 620 | 30 x 30 |
| 530 x 470 | 470 x 410 | 30 x 30 |
| 540 x 540 | 480 x 480 | 30 x 30 |
| 21.65" x 21.65" | | |
| 550 x 470 | 490 x 410 | 30 x 30 |
| 21.65" x 18.50" | | |
| 584 x 584 | 524 x 524 | 30 x 30 |
| 23" x 23" | 534 x 508 | 25.4 x 38.1 |
| 600 x 500 | 540 x 440 | 30 x 30 |
| 23.62" x 19.68" | | |
| 600 x 550 | 540 x 490 | 30 x 30 |
| 550 x 400 | 490 x 340 | 30 x 30 |
| 700 x 570 | 640 x 510 | 30 x 30 |
| 27.56" x 22.44" | | |
| 340 x 290 | 280 x 210 | 30 x 30 |
| 550 x 550 | 490 x 490 | 30 x 30 |
| 21.65" x 21.65" | | |
| 490 x 490 | 410/430 x 430 | 40/30 x 30 |
| 800 x 580 | 740 x 520 | 30 x 30 |
| 500 x 500 | 440 x 440 | 30 x 30 |
| 19.68" x 19.68" | | |
| 400 x 450 | 340 x 390 | 30 x 30 |



Table/view 1: Sizes and views of standard aluminium frame

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Frames and tensioning systems for SMD stencils

Production process of SMD stencils in frames

Cast aluminium frames

Cast aluminium frames are primarily used when high stability and consistency with high mesh tension are required. Upon special request, frames can be provided with thread holes for better handling, for special screen printing machines, or with threaded bushings or fitting bushings. For maximum durability, the adhesive side of the frame is sand-blasted for optimum adhesion of the mesh to the frame. Cast aluminium frames are delivered in many sizes (see table/view 2). The trade-off for obtaining the proven benefits of cast aluminium frames is a higher price and a high total weight. Cast aluminium frames can be used multiple times over many years, just like light aluminium frames.

Advantages

- high stability
- high consistency
- high mesh tension

Stainless steel frame

An additional alternative to aluminium is the stainless steel frame. Stainless steel frames do not differ in size and shape from standard aluminium frames. They are, like tubular aluminium frames, water-proof welded with polished welding seams. The adhesive surface is sandblasted to ensure an optimum adhesion from the mesh to the frame. If required, the frames are provided with thread holes for better handling in special screen printing machines. Fitting bushings are also possible. Stainless steel frames are extremely durable and can be used multiple times.

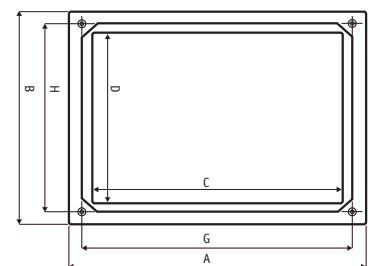
Profile

For standard aluminium frames, the most commonly used square and quadratic profile tubes are either 30 mm x 30 mm or 40 mm x 40 mm with a wall thickness of 3.0 mm/1.8 mm or 2.8 mm/2.0 mm (see picture 3). The corresponding sizes can be seen in table/view 1. A special alternative is the „Slope“ profile with a diagonal inner-edge (see picture 1). The Slope profiles are extremely stable and can accommodate a higher-mesh tension (similar to stainless steel profiles). Slope profile frames are lightweight, easy to handle, and the diagonal inner edge helps to provide fast and easy cleaning of the frames.

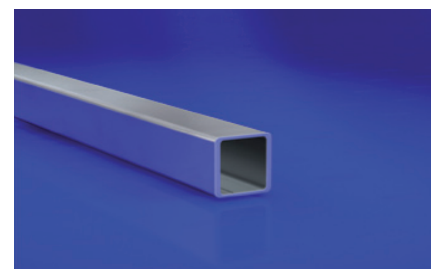
Advantages

- higher stability
- higher mesh tension possible
- fast cleaning

| Typ | outside dimensions (mm, A x B) | inside dimensions (mm, C x D) | thread distance (mm, G x H) | frame thickness (mm) | edge height (mm) | thread | weight (kg) |
|------|-----------------------------------|----------------------------------|--------------------------------|-------------------------|---------------------|--------|----------------|
| 68 | 250 x 185 | 210 x 145 | 203.20 x 170.20 | 19 | 9.5 | M4 | 0.54 |
| 810 | 302 x 245 | 255 x 199 | 273.06 x 215.90 | 19 | 9.5 | M6 | 0.78 |
| 1010 | 300 x 300 | 250 x 250 | 254 x 254 | 20 | 8 | M6 | 1.25 |
| 1212 | 355 x 355 | 305 x 305 | 330 x 330 | 25.5 | 12.75 | M6 | 1.50 |
| | 431.8 x 431.8 | 381 x 381 | 406.4 x 406.4 | 25.0 | 5 | 1/4" | 3.20 |
| 1515 | 450 x 450 | 381 x 381 | 407 x 407 | 25.0 | 5 | M6 | 3.35 |
| 2020 | 584 x 584 | 508 x 508 | 533 x 533 | 25.5 | 6.7 | M6 | 5.20 |



Table/view 2: Sizes and views of cast aluminium frames



Picture 3: Square profile 30x30x3x1,8mm

Stainless steel sheet for stencils

The stainless steel sheets, which are used for the stencils, have specific properties such as special hardness and tensile strength. Only stainless steel sheets with low material thickness tolerances are used.

Material: stainless steel 1.4301 (full hard)
Hardness (Hv): min. 370
Tensile strength (N/mm²): > 1100
Material thickness tolerance: ± 3 %

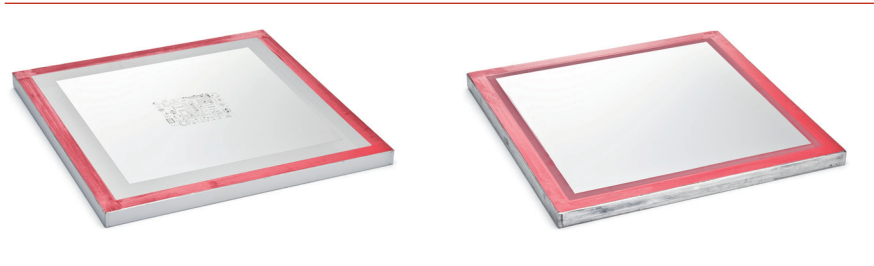
Dimensions of stainless steel materials
SMD stencils are available in metal sheet thicknesses of (µm):
20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 130, 140, 150, 180, 200, 250, 300, 400
SMD stencils in VectorGuard® tensioning systems are available in metal sheet thicknesses of (µm):
80, 100, 120, 130, 150, 180, 200, 250
Maximum thickness of metal sheets: 2 mm
Maximum machine surface:
800 mm x 600 mm

Tensioning/screen tension

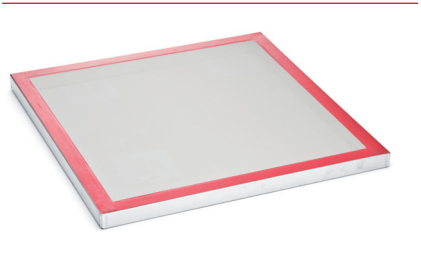
All standard stencils are manufactured with a screen made of stainless steel with high-precision mesh. The standard stainless steel screen is delivered in 80 mesh (mesh/inch) and is tensioned in a 90° angle. The diameter of the screen wire is 0.1 mm. The SMD stencil is delivered with a tensile strength of 40 N/mm² to achieve optimum printing results. If required, screen filler can be applied to facilitate cleaning (see picture 4).

Production process of stencils in frames

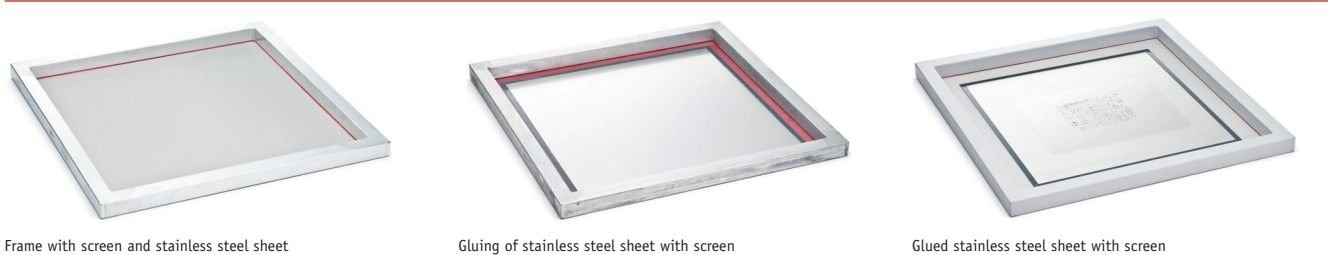
Before the tensioning process takes place, the frames are inspected for flatness. If a used frame is to be recycled, a cleaning step for the frame is involved and the surface for the gluing area is roughened afterwards. In a tensioning machine, the frame is mechanical or pneumatically fixed with the screen and then regulated to the required tension. The screen is glued with an adhesive and, after the curing process, the screen is fixed tight to the frame (see picture 6).
In the tensioned frame, the stainless steel sheet (in the corresponding size) is fixed-in with an adhesive from the squeegee side of the frame. The glue is then cured. In this way, the stainless steel sheet takes-over the tension of the screen. After the curing process, the screen material is cut out. The apertures are cut in strained condition with an aperture accuracy of ± 10 µm.



Picture 4: Stencil with/without screen filler



Picture 5: Frame tensioned with stainless steel screen



Picture 6: Production process for a stencil in frame



Picture 9: Tensioning system with stencil



Picture 10: Coloured stencil corners

Stencils in tensioning systems

Stencils in tensioning systems are available with different perforations and device carriers. The tension is generated mechanically or pneumatically and is evenly spread over the entire stainless steel sheet. Most stencils in tensioning systems show a lower tensile strength than stencils in frames. In addition, they do not provide sufficient protection from damage (such as bending). Most of the tensioning systems are delivered with an edge protector to avoid risk of injury (see picture 7). Furthermore, by flanging the edges, increased stability is achieved. Tensioning systems are a lower-cost alternative to stencils in frames and are also a space-saving alternative.

LaserJob's first-generation tensioning system LJ 745 was developed in 1999. In 2013, a new "high-stability" frame system was introduced to the market, see picture 8. The high stability is accomplished through the use of aluminium stabilizers which are mounted on the underside of the stencil. By integrating these stabilizers into the stencil, bending & folding of the stencil is prevented, see picture 9.

Stencil foils as thin as 1 mil (25 µm) can be repeatedly pulled to a high tension of 40N/cm, thus guaranteeing the high position accuracies required for ultra-fine-pitch applications. The new "backlight" option acts as a secondary inspection tool which can highlight defects such as anomalies in pad shape and blocked apertures. The tensioning system is available in both sizes 23"x 23" and 29"x 29". Black corner tabs are utilized for standard applications (see picture 10) while optional green corner tabs can be employed for RoHS directives and unique product identification. For further information regarding the tensioning system LJ 745, see [data sheet 1.3](#).

LaserJob is cutting stencils for following tensioning systems

- VectorGuard®
- Alpha Tetra/Vector/MicroMount
- QuattroFlex/Stencilman
- ZelFlex Z4P



Picture 7: Tensioning system with edge protection



Picture 8: Aluminium profile

VectorGuard® tensioning system

The VectorGuard® tensioning system is a four-sided spring clamping system for SMD stencils with blue colored frames (see picture 11). It is available in standard sizes of 23"x 23" and 29"x 29". In addition, green edges can be implemented in the blue colored frames to distinguish the products. SMD stencils in the VectorGuard® tensioning system are only available in limited material thicknesses (µm):
80, 100, 120, 130, 150, 180, 200, 250
In mil: 3, 4, 5, 6, 7, 8, 10

Alpha Tetra tensioning system

The Alpha Tetra tensioning system is a four-sided clamping system for SMD stencils with a specific perforation on all four sides (see picture 12). The system is also suitable for the MicroMount or Vector perforation. The Alpha Tetra tensioning system is available in 3 standard sizes in all material thicknesses.

Stencilman tensioning system

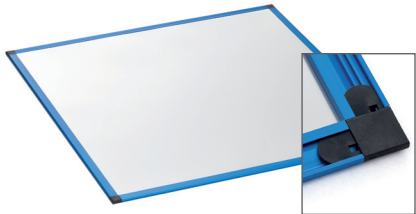
The Stencilman tensioning system with the perforation of a QuattroFlex tensioning system works with a tensile strength generated from compressed air and is deliverable in two sizes (see picture 13). It is available in all material thicknesses.

ZelFlex Z4P tensioning system

The ZelFlex Z4P tensioning system is a pneumatic system with a patent-protected compressed air system (see picture 14). It is offered in two standard sizes and is available in all material thicknesses.

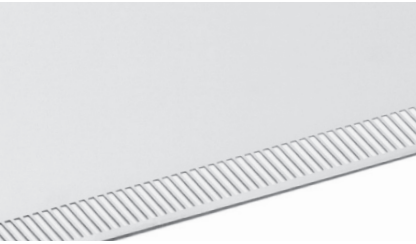
Other systems are available on request.

| VectorGuard® | outside dimensions in mm | sheet size in mm |
|--|-----------------------------|---------------------|
| VG 260 standard size: 23" x 23" | 584 x 584 (23" x 23") | 555.5 x 555.5 |
| VG 265 standard size: 29" x 23" | 736 x 584 (29" x 23") | 708 x 555.5 |
| Expandable with adapter set to outside dimensions of 736 x 736 mm: 29" x 29" | 736 x 736 (29" x 29") | 708 x 555.5 |



Picture 11: VectorGuard® tensiometer system

| Alpha Tetra | outside dimensions in mm | sheet size in mm |
|---|-----------------------------|---------------------|
| standard size: 17" x 17" Expandable with adapter set to outside dimensions of: 584 x 584 mm; 23" x 23" | 430 x 430 (17" x 17") | 404 x 404 |
| standard size: 23" x 23" Expandable with adapter set to outside dimensions of: 736 x 736 mm; 29" x 29" | 584 x 584 (23" x 23") | 558 x 558 |
| standard size: 23" x 29" Expandable with adapter set to outside dimensions of: 736 x 736 mm: 29" x 29" | 584 x 736 (23" x 29") | 558 x 711 |



Picture 12: Alpha Tetra tensiometer system

| Stencilman | outside dimensions in mm | sheet size in mm |
|---|-----------------------------|---------------------|
| standard size: 23" x 22,28" 584 x 566 mm | 584 x 566 (23" x 22,28") | 555.5 x 555.5 |
| standard size: 28,35" x 23" 720 x 584 mm | 720 x 584 (28,35" x 23") | 709.5 x 555.5 |



Picture 13: Stencilman tensiometer system

| ZelFlex Z4P | outside dimensions in mm | sheet size in mm |
|--|-----------------------------|---------------------|
| standard size: 23" x 23" 584 x 584 mm | 584 x 584 (23" x 23") | 558 x 558 |
| standard size: 29" x 29" 736 x 736 mm | 736 x 736 (29" x 29") | 711 x 711 |



Picture 14: ZelFlex Z4P tensiometer system

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Quality control

Quality assurance is paramount at LaserJob. Effective quality control starts with incoming inspection of the stainless steel sheets and stencil frames. A thickness measurement instrument controls every stainless steel sheet with an accuracy of $\pm 0.5 \mu\text{m}$. The screen tension is measured from each screen printing frame. Directly after the laser cutting process, aperture size and aperture geometry are inspected. The OKM measurement system detects on an area of 400 mm x 200 mm with a precision of $2.5 \mu\text{m} + L/400$ the position of the apertures. The contour of apertures is controlled with an accuracy of $0.5 \mu\text{m}$ with a CCD camera with back light. ScanCheckI+ compares the produced stencil with original data and examines the congruency.

Variations

- NanoWork®-stencil
- PatchWork®-stencil (Step stencil)
- 3D PatchWork®-stencil
- combination PatchWork®-stencil with NanoWork®-coating
- stencil in screen printing frame glued over stainless steel mesh
- in tensioning system LJ 745
- in Quattroflex tensioning system
- in VectorGuard® tensioning system
- in Alpha Tetra/Micromount/Vector tensioning system
- in Zelflex tensioning system
- in Stencilman tensioning system
- in different customer-specific tensioning system

Service

LaserJob offers a full range of consulting services for layout and design. Our team generates, from your CAD-CAM data, automatic cutting instructions for the laser. Our highly focused laser systems cut with high positioning accuracy the apertures.

We offer additional

- scaling apertures up and down
- changing aperture design, e.g. home plates and rounding sharp corners
- optimizing apertures (anti tombstone design)
- rotating or mirroring of the whole design or sub-areas
- control of aspect and area ratios
- generation of stencils with multiple panels
- generating layouts from existing PCBs
- generating stencil layouts for adhesive applications
- customer-specific storage for used frames. The frames will be cleaned, re-strung and provided for new orders. Your actual inventory is always retrievable.
- data storage
- test certificates (as well as customer's specifications)
- data for solder paste inspection systems
- Data Matrix Code
- measuring of printed circuit boards
- production of stencils from provided PCBs, stencils, or films

Shipping conditions

Shipping time

Standard shipment time ex works is 3 work days
Order entry before 5 p.m. (= first work day)

24 hour express shipment –
Confirmed orders will be shipped the next day
Order entry before 5 p.m.

6 hour express shipment –
Confirmed orders will be shipped the same day
Order entry before 1 p.m.

Common carrier: TNT, UPS, DHL, GO, FedEx (any shipping service) as well as direct shipments with courier delivery with partner companies.

Packaging

All LaserJob stencils are shipped in reusable packaging. To avoid damage of stencils, proven packaging materials are used. We deliver stencils in specialty packaging as well as per customer request.

For tensioning systems, two storage bags are offered (see picture 15).

Order process

To guarantee fast handling of your order, send the purchase order via

- e-Mail: mail@laserjob.de
- fax: +49 (0) 8141 52778-60
- post

Please send the gerber files for the stencils via e-mail to mail@laserjob.de

We are ISO 9001:2015 certified



Picture 15: Storage bag

LaserJob data sheets

- 1.0 SMD stencil
 - 1.1 NanoWork®-stencil
 - 1.2 PatchWork®-stencil
 - 1.3 Tensioning system LJ 745
 - 1.4 Frames and tensioning systems
 - 1.5 Repair and Re-balling stencil
 - 1.6 Wafer bumping-stencil
 - 1.7 LTCC Via fill-stencil
- 2.0 Laser Material Processing

Auch in Deutsch erhältlich.

