

Tables, Breadboards, & Rails

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Optics

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Coatings

Mirrors, Beamsplitters & Windows

Prisms & Polarizers

Filters

Pinholes

Opto-mechanics

Tables, Breadboards & Rails

Mounting Hardware

Mirror & Component Mounts

Manual Micro-positioners

Motorized Positioners

Lasers & Accessories

Beam Delivery

Laser Measurement

Diode Laser Modules

Optical Table Systems

Technical Overview

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- Superior performance
- Excellent rejection of external vibrations
- Low static deflection
- Maximum table top internal damping
- High dynamic rigidity
- Flat and spill-proof surface



Opto-mechanics

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The ideal optical table system should provide a rigid, stable, vibration-free work surface which can be used for mounting optical components and photonics instruments such as lasers and interferometers. LaserTop™ Optical Table systems from TMC have been optimized for this purpose.

Table systems in the optics laboratory are subjected to loading forces and vibrations that can couple to the table top causing either static or dynamic deformations of the working surface. These deformations are particularly undesirable when carrying out sensitive optical alignments. The major sources of table top deformation and the frequencies at which these commonly occur are:

- Floor vibrations originating from people walking near the table, nearby heavy machinery, road traffic, and natural resonances of the building. These are usually above 10 Hz but can be lower if the laboratory is not on the ground floor.
- Acoustic vibrations. These are usually above 20 Hz.

- Deflection caused by heavy stationary or slowly moving loads on the table top.
- Vibrations caused by electronic instruments mounted on the table top. These are usually above 10 Hz and at the mains power frequency or one of its harmonics (ie, 50, 60, 100 or 120 Hz).

The ideal optical table system, consisting of a table top on an isolator, would have the following:

- An active isolator with very low transmissibility above 10 Hz, to isolate the table top from floor vibrations.
- Rigid construction using materials with a high Young's Modulus so that heavy loads do not deform the table when moved.
- A high first resonant frequency, preferably above the frequency of any vibrational forces caused by instrumentation mounted on the table.
- Maximum damping at the table's natural resonances and across a broad frequency spectrum.

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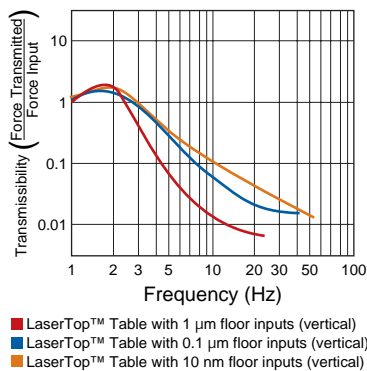
- Opto-mechanics
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Performance Parameters

Transmissibility of Pneumatic Isolator System

The transmissibility of an isolator system is usually given in a curve showing isolation efficiency or transmissibility as a function of input frequency (floor vibration). The transmissibility is simply the ratio of the force reaching the tabletop compared to the floor force applied to the Isolator, and is thus a measure of the de-coupling between them.



Static Deflection

This is a measure of how much a table top bends under load and is a good indicator of the overall stiffness of a table under static conditions. Units for Static deflection are mm/N, and it is usually specified as the deflection measured when a 114 kg (250 lb) load is placed in the center of the table top. The

Young's Modulus of the skin material and core material are the key to achieving a rigid table with a small deflection under load. TMC uses steel honeycomb core material that has a Young's Modulus of 19,300 kg/cm² (275,000 psi) to ensure a low static deflection.

Dynamic Rigidity

Compliance or dynamic rigidity is a measure of the relative flexure of the table top when subjected to vibrational forces over a broad frequency range. It is usually expressed as a graphic plot of table surface displacement per unit force as a function of frequency. As a rule shorter and thicker tables are dynamically more rigid than longer thinner tables. For demanding applications a length to thickness ratio of 8:1 and for less demanding applications 10:1, is recommended. The exact location on a table where compliance measurements are made will affect the amplitude of deflection data. When comparing table specifications it is important to ensure that similar measurement positions have been used. All compliance data for TMC tables have been obtained at corner positions where the deflection is usually greatest representing worst case performance.

The TMC Solution

LaserTop Optical Table systems have been designed to give performance as close to that of an ideal table system as possible. They provide a superior platform for photonics work.

TMC Pneumatic Isolators are designed to de-couple the table top from floor vibrations; they actually transmit less than 1% (Transmissibility = 0.01) of the vibrational forces above 10 Hz. TMC LaserTop optical table tops are rigid, and have the lowest possible static deflection figures. They have internal damping designed to give low compliance and dynamic deflection coefficients (maximum dynamic deflection coefficient 6.38 x 10⁻⁴, for a 1200 mm x 2400 mm x 300 mm thick table). LaserTop table tops also have high first resonant frequencies (f_n = 170 Hz, for a 1200 mm x 2400 mm x 300 mm thick table).

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Lowest Resonant Frequency f_n

All optical tables exhibit a similar pattern in their compliance curves - a series of peak displacements or resonances which diminish in amplitude with increasing frequency. Any external disturbance (such as vibration or impact) will therefore have a greater effect on the behavior of the table at the lower rather than the higher frequencies. The first resonant peak of a compliance curve is significant because it usually produces the largest deflection. The frequency at which this occurs is a further indication of the dynamic stiffness of a table. Generally, the higher the first resonant frequency of a table the less reactive it will be to a given excitation force and the more stable it will be. Also, the typical spectrum of noise and vibration generated by most laboratory equipment is in the range 0-150 Hz - so the higher a table's natural resonant frequency, the less likely will it be influenced by neighboring equipment.

Q Factor

The Q factor of the table top is a measure of how well it is damped at the lowest

resonant frequency. It is defined as the ratio of the compliance at f_n to that of an ideal rigid body at the same frequency. This performance parameter can be confusing since better Q values can be achieved using tuned damping at this single frequency. However, once loaded, the table resonance will shift and the table may not be optimally damped using a tuned damping technique. TMC uses broadband maximum damping on all LaserTop™ tables for the best performance under a wide range of load conditions.

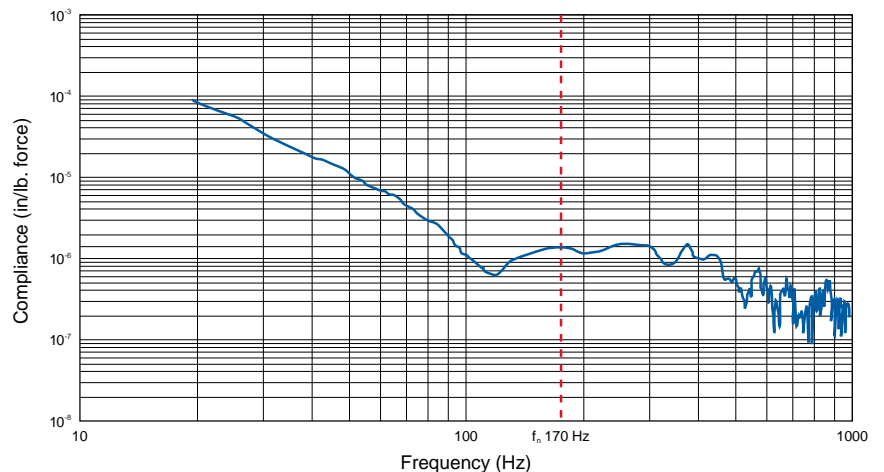
Dynamic Deflection Co-efficient

This is defined as $(Q/f_n^3)^{0.5}$ and is taken from the compliance curve data at the lowest resonant frequency. Again this only takes into account performance at this specific frequency under no load conditions. This parameter is therefore not that useful for real world comparisons of table tops.

Relative Table Top Motion

This is a relative motion value calculated at one specific frequency, the lowest resonant frequency.

Corner Compliance Data (for a 1200 x 2400 x 300 mm table)



LaserTop™ Construction

- Sealed top all-steel construction
- 5 mm thick stainless steel top plates
- High density small cell core
- Superior broadband damping
- Pressure bonded skins
- Steel to steel bonding throughout giving unmatched stiffness

The key to producing the very best optical table top is an all steel construction with the smallest possible closed cell steel core design. LaserTop table tops have a steel honeycomb core which is directly bonded top and bottom to steel plates. The use of a steel honeycomb affords a much higher stiffness to mass ratio than anything available from a solid metal or granite table and in addition has far superior damping properties. TMC is able to achieve a core cell size of 3.2 cm² (½ inch²) using a patented process. Acid resistant plastic cups provide a spill proof, and hence corrosion proof, table top.

The honeycomb core has a high shear modulus of 19,300 kg/cm² (275,000 psi). This results in a stiff and well damped optical table. Furthermore, the steel core material is attached directly to the table surfaces. The diagram below shows a

cross section detailing LaserTop table top construction.

The side walls of TMC tables are constructed of 2 mm thick steel. They are acoustically damped to minimize vibrations and provide unbeatable structural strength.

All TMC LaserTop top plates are made of ferro-magnetic stainless steel which is 5 mm (⅜ inch) thick. This is the optimum skin thickness to balance the core characteristics. The top plates are stretcher levelled, stress relieved and bonded under pressure against a precision lapped reference plate. No surface grinding is necessary, thereby avoiding thermal or stress deformation. Only a light sanding is given to provide a matte finish of low reflectivity. The surface on all tables is flat to within ±0.13 mm (0.005 inch) over the full table length and locally to 0.10 mm.

Specifications

Top Plate: 5 mm (⅜ inch) thick ferro-magnetic stainless steel

Flatness: ±0.13 mm end to end
±0.10 mm over 1 sq. m

Mounting Holes: M6 on 25 mm centers (Metric), or ¼-20 on 1 inch centers (Inch)

Top Plate Seal: Plastic cups under holes, hermetically sealed

Honeycomb Material: Corrosion resistant steel hexagonal section, no cutting oils or other volatile materials

Core Density: 300 kg/m³ (18-20 lb/ft³)

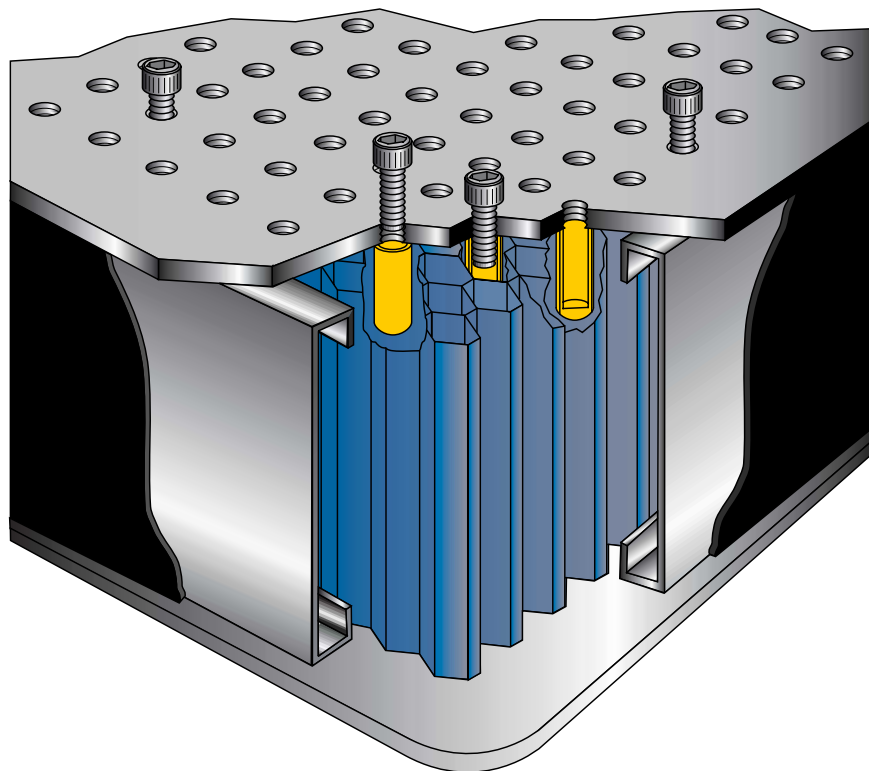
Core Shear Modulus: 19,300 kg/cm² (275,000 psi)

Bonding Material: High strength aerospace grade epoxy resin free from hysteresis and visco-elastic creep

Damping: Rigid bonding and proprietary mass damping devices

Bottom Plate: 5 mm (⅜ inch) thick ferro-magnetic steel

Side Walls: Steel, backed by stiff damping panels



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LaserTop™ Optical Tables



- *Stainless steel pressure bonded skins*
- *Small closed cell steel honeycomb core material*
- *Individual solvent resistant cups under each tapped hole*
- *Steel to steel bonding throughout giving unmatched stiffness*
- *High shear modulus core*
- *Superior broadband damping*

The 300 mm (12 inch) thick LaserTop™ optical table tops are ideal for the most demanding applications such as interferometry, holography, laser research, semiconductor inspection systems, and metrology. The length to thickness ratio of better than 8:1 ensures the most rigid and well damped foundation for these types of application.

Pneumatic Isolator Stands



Pneumatic Isolator Stands are also available for use with these tables.

Typical Performance Values

Lowest Resonant Frequency f_n : 170 Hz

Q-Factor: 2.0

Maximum Dynamic Deflection

Coefficient: 6.38×10^{-4}

Maximum Relative Motion Value:

$<0.12 \text{ nm}$ (4.94×10^{-9} inches)

Static Deflection under Load of 114 kg

(250 lb): $1.27 \text{ }\mu\text{m}$ (5.0×10^{-5} inches)

(data derived from corner compliance curves for a LaserTop Table 1200 mm x 2400 mm x 300 mm thick with active isolator transmissibility of 0.01, quiet lab conditions)

LaserTop™ 300 mm thick Optical Tables (Metric)

Catalog Number Metric	Width x Length (mm)	Thickness (mm)	Compliance (mm/Nx10 ⁻⁶)	Resonance (Hz)	Static Deflection* (μm)	Weight (kg)	Use Isolator	Price US
53-9213	1200 x 2400	300	14.3	170	1.27	618	F	\$5,859.00
53-9221	1200 x 3000	300	25.7	135	2.23	695	G	\$6,426.00
53-9247	1500 x 3000	300	25.7	135	2.23	868	I	\$9,135.00
53-9254	1500 x 3600	300	37.1	110	3.81	1041	J	\$11,277.00

LaserTop™ 12 inch thick Optical Tables (Inch)

Catalog Number Inch	Width x Length (ft)	Thickness (inches)	Compliance (inches/lbx10 ⁻⁶)	Resonance (Hz)	Static Deflection* (inches x 10 ⁻⁵)	Weight (lb)	Use Isolator	Price US
61-9213	4 x 8	12	2.5	170	5.0	1360	F	\$5,859.00
61-9221	4 x 10	12	4.5	135	8.8	1530	G	\$6,426.00
61-9247	5 x 10	12	4.5	135	8.8	1910	I	\$9,135.00
61-9254	5 x 12	12	6.5	110	15.0	2290	J	\$11,277.00

* For a 114 kg (250 lb) Load placed in center of supported table.

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LaserTop™ Optical Tables

- Superior performance, yet affordably priced
- Individual solvent resistant cups under each tapped hole
- Steel to steel bonding throughout giving unmatched stiffness
- High shear modulus core
- Superior broadband damping



Typical Performance Values

Lowest Resonant Frequency f_n : 135 Hz
Static Deflection under Load of 114 kg (250 lb): 3.81 μm (15.0×10^{-6} inches)
 (data derived from corner compliance curves for a LaserTop Table 1200 mm x 2400 mm x 200 mm thick and with active isolator transmissibility of 0.01, quiet lab conditions)

These 200 mm (8 inch) thick LaserTop™ Optical Tables are ideally suited to optics research and laser experiments. The shorter 1500 mm, 1800 mm and 2400 mm tables with a length to thickness ratio of less than 12:1 suit the most demanding of applications and are an ideal for interferometry and

other sensitive photonics applications. They offer a more compact alternative to a 300 mm (12 inch) thick table top. The longer tables are ideal for optics research where excessive loading is not expected but maximum dynamic rigidity and stability are required.

LaserTop™ 200 mm thick Optical Tables (Metric)

Catalog Number Metric	Width x Length (mm)	Thickness (mm)	Compliance (mm/Nx10 ⁻⁹)	Resonance (Hz)	Static Deflection* (μm)	Weight (kg)	Use Isolator	Price US
53-9171	1200 x 1800	200	17.1	160	1.95	346	K	\$3,696.00
53-9189	1200 x 2400	200	31.4	135	3.81	461	L	\$4,447.00
53-9197	1200 x 3000	200	57.0	110	6.35	576	M	\$5,544.00
53-9700	1500 x 2400	200	31.4	135	3.81	576	O	\$6,463.00
53-9718	1500 x 3000	200	57.0	110	6.35	720	P	\$8,073.00

LaserTop™ 8 inch thick Optical Tables (Inch)

Catalog Number Inch	Width x Length (ft)	Thickness (inches)	Compliance (inches/lb x 10 ⁻⁶)	Resonance (Hz)	Static Deflection* (inches x 10 ⁻⁵)	Weight (lb)	Use Isolator	Price US
61-9171	4 x 6	8	3.0	160	7.5	761	K	\$3,696.00
61-9189	4 x 8	8	5.5	135	15.0	1014	L	\$4,447.00
61-9197	4 x 10	8	10.0	110	25.0	1267	M	\$5,544.00
61-9700	5 x 8	8	5.5	135	15.0	1296	O	\$6,463.00
61-9718	5 x 10	8	10.0	110	25.0	1620	P	\$8,073.00

* For a 114 kg (250 lb) Load placed in center of supported table.

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LaserTop™ Optical Breadboards



- *Portable*
- *Ideal for prototyping*
- *Spill proof*
- *Excellent bases for optical instruments*
- *Can be set up with a configuration and stored for later use*

The LaserTop™ 50 mm (2 inch) thick Optical Breadboards are made to the same high standards the TMC LaserTop table tops. Their all-steel construction results in one of the stiffest breadboards available making them ideal for small sized optical research experiments. They may also be mounted vertically (on their side) as part of a larger table system.

The top skins are made of ferro-magnetic stainless steel which is 5 mm ($\frac{9}{16}$ inch) thick. This is bonded directly to a small cell steel honeycomb core with a high Young's Modulus of 19,300 kg/cm², this results in an exceptionally stiff research quality breadboard.

Breadboards are available in metric (M6 holes on 25 mm centers) and inch series ($\frac{1}{4}$ -20 holes on 1 inch centers). The threaded holes are backed by individual sealed plastic cups, that completely seal off the core making them safe for use with hazardous solvents or corrosive liquids such as laser dyes, since accidental spills are easily contained.

TMC LaserTop 50 mm thick

LaserTop™ 50 mm thick Optical Breadboards (Metric)

Catalog Number Metric	Width x Length (mm)	Thickness (mm)	Weight (kg)	Price US
53-9007	300 x 600	50	18	\$739.00
53-9023	600 x 900	50	54	\$1,150.00
53-9031	600 x 1200	50	72	\$1,358.00
53-9064	900 x 1200	50	108	\$1,762.00
53-9072	900 x 1500	50	135	\$2,079.00

LaserTop™ 2 inch Optical Breadboards (Inch)

Catalog Number Inch	Width x Length (ft)	Thickness (inches)	Weight (lbs)	Price US
61-9007	1 x 2	2	40	\$739.00
61-9023	2 x 3	2	119	\$1,150.00
61-9031	2 x 4	2	158	\$1,358.00
61-9064	3 x 4	2	238	\$1,762.00
61-9072	3 x 5	2	297	\$2,079.00

Specifications

Top Plate: 5 mm thick stainless steel

Bottom Plate: 5 mm thick steel

Flatness: ± 0.13 mm

Core: Steel honeycomb, closed cell

Core Shear Modulus: 19,300 kg/cm² (275,000 psi)

Side Walls: Steel

Damping: Broadband damping

Threaded Holes - Metric Series: M6 on 25 mm centers

Threaded Holes - Inch Series: $\frac{1}{4}$ -20 on 1 inch centers

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Lightweight Steel Breadboards

- *Stainless steel top and bottom skins*
- *All steel design*
- *Lightweight yet rigid design*
- *Low cost alternative to LaserTop™ Breadboards*
- *Available from stock*
- *Sealed spill-proof holes*



These Lightweight Steel Breadboards offer a low cost alternative to a high specification research grade breadboard such as the LaserTop™ series. They incorporate the same ultra-stiff steel core material as the LaserTop but with thinner (2 mm thick) top and bottom skins. The top and bottom skins are both made from stainless steel, the use of which prevents any bowing due to temperature changes. These skins are directly bonded to a high density steel honeycomb core material

providing both rigidity and natural damping. A special fabrication technique is used to stretch the steel top skin where the holes are drilled. This effectively forms a thicker channel in the top giving a full three threads of purchase for every mounting hole.

This economical, but sound design provides a range of breadboards that minimize both cost and weight. They effectively fill the gap between simple

solid Aluminum Plate Breadboards and the high specification LaserTop series Breadboards. TMC Lightweight Steel Breadboards are available in metric (M6 holes on 25 mm centers) and inch series (¼-20 holes on 1 inch centers). The threaded holes are backed by individual sealed plastic cups, that completely seal off the core making them safe for use with hazardous solvents or corrosive liquids such as laser dyes, since accidental spills are easily contained.

Specifications

Top Plate: 2 mm thick stainless steel (with formed mounting holes)

Bottom Plate: 2 mm thick stainless steel

Flatness: ±0.13 mm

Core: Steel honeycomb, closed cell

Core Shear Modulus: 19,300 kg/cm² (275,000 psi)

Side Walls: Laminate

Damping: Natural core damping

Threaded Holes - Metric Series: M6 on 25 mm centers

Threaded Holes - Inch Series: ¼-20 on 1 inch centers

Weights: 44 kg/m² (9 lb/ft²)

Lightweight Steel Breadboards (Metric)

Catalog Number Metric	Width x Length (mm)	Thickness (mm)	Weight (kg)	Price US
53-9262	450 x 600	50	14	\$583.00
53-9270	450 x 1200	50	28	\$765.00
53-9288	600 x 600	50	17	\$638.00
53-9296	600 x 900	50	25	\$760.00
53-9304	600 x 1200	50	34	\$875.00
53-9312	900 x 1200	50	50	\$1,089.00

Lightweight Steel Breadboards (Inch)

Catalog Number Inch	Width x Length (inches)	Thickness (inches)	Weight (lb)	Price US
61-9262	19 x 23	2	31	\$583.00
61-9270	19 x 47	2	62	\$765.00
61-9288	23 x 23	2	37	\$638.00
61-9296	23 x 35	2	55	\$760.00
61-9304	23 x 47	2	75	\$875.00
61-9312	35 x 47	2	110	\$1,089.00

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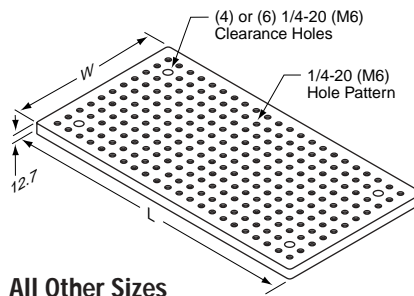
Aluminum Plate Breadboards



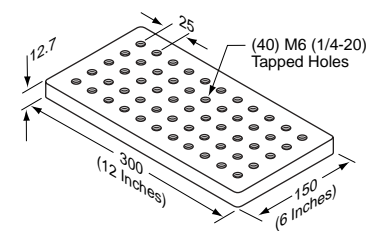
- Solid 12.7 mm thick aluminum plate
- Black - low reflective surface
- Metric and Inch hole patterns

These solid aluminum threaded plates provide a useful low cost base for building optical systems or prototypes. The 12.7 mm (1/2 inch) thick plates have a low reflectance black finish and are offered in a range of sizes to suit most applications. They are available in both

metric (M6 holes on 25 mm centers) and inch series (1/4-20 holes on 1 inch centers). Holes are tapped right through the plates providing greater flexibility. They may also be mounted above the surface of an optical table or breadboard with the aid of a set of pillars.



All Other Sizes



54-1888/62-1888

Specifications

Material: Aluminum alloy
Thickness: 12.7 mm (1/2 inch)
Finish: Matte black
Tapped holes -
Metric Series: M6 on 25 mm centers
Inch Series: 1/4-20 on 1 inch centers
Weight: 30 kg/m² (6 lb/ft²)

Aluminum Plate Breadboards (Metric)

Catalog Number Metric	Width x Length (m)	Price US
54-1888	0.15 x 0.3	\$151.00
54-1896	0.3 x 0.3	\$215.00
54-1904	0.3 x 0.6	\$357.00
54-1912	0.3 x 0.9	\$489.00
54-1920	0.6 x 0.6	\$713.00
54-1938	0.6 x 0.9	\$1,075.00

Aluminum Plate Breadboards (Inch)

Catalog Number Inch	Width x Length (ft)	Price US
62-1888	0.5 x 1	\$151.00
62-1896	1 x 1	\$215.00
62-1904	1 x 2	\$357.00
62-1912	1 x 3	\$489.00
62-1920	2 x 2	\$713.00
62-1938	2 x 3	\$1,075.00

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