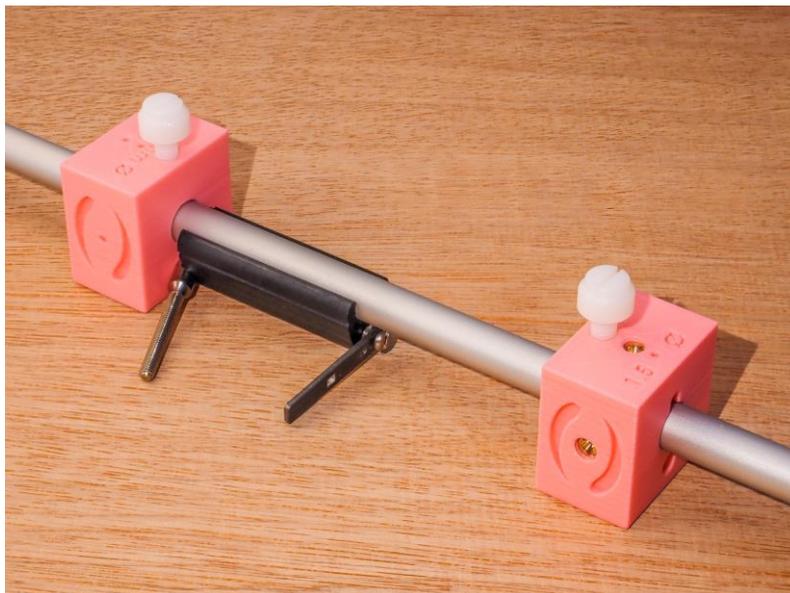


SAILSetc Drill Guide Block

DB-110 for 11.1 spars

Introduction

The guide block is used to drill rigging holes in 11.0 and 11.1 mm Ø masts and 11.0 mm Ø booms, ensuring exact alignment of 1.5 mm Ø holes for spreaders, shrouds, and forestay attachments on a mast, and accurately spaced Z-hook holes for the sheets on main and headsail booms. Using two blocks on the mast enables perfect alignment between all the holes, where one block holds the mast in position and the other is placed as needed for each set of holes. Additionally, the blocks can be used to accurately mark gooseneck attachment holes.



Mast with two blocks set

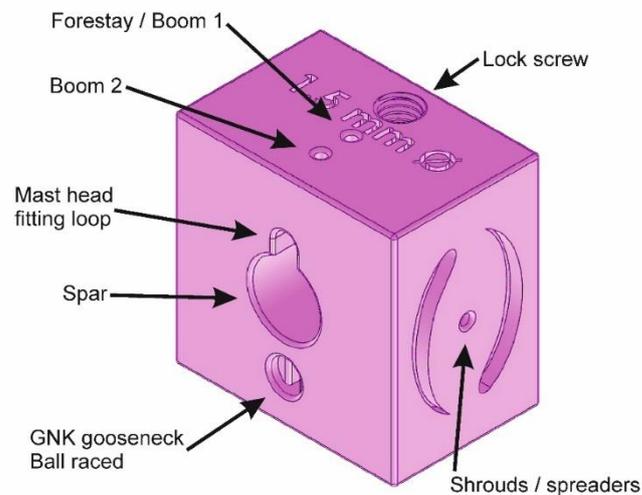
The “standard” block has guide holes that are not bushed. While the holes will wear over time, their expected life is still long if the block is used with care. The “metal” block has brass bushed guide holes which will give a much longer precision life.

Both types of block have alignment slots for SAILSetc goosenecks (standard and ball-raced, whether glass-filled plastic bodies, metal bodies, or legacy metal bodies) to ensure exact alignment of the mast rigging holes with reference to the gooseneck if that is fitted first, or exact alignment of the gooseneck if fitted after the rigging holes have been drilled.

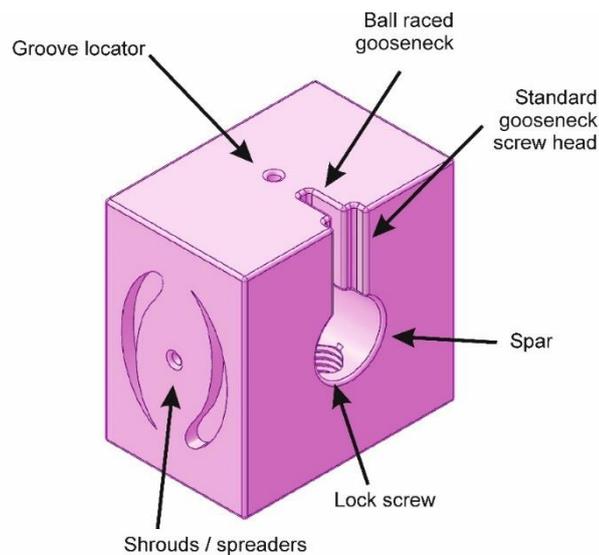
Both types of block also have an alignment location for SAILSetc mast head fittings which have a burgee loop, and an auxiliary hole on their aft face which permits accurately positioning the block with respect to the groove of a GROOVY mast spar.

Design

After some experimentation, a block size of 36 × 36 × 24 mm was found to give the best balance of size, bearing surface, and ease of use. The diagrams below identify the various openings, slots, and guide holes.



Top, right, and front faces

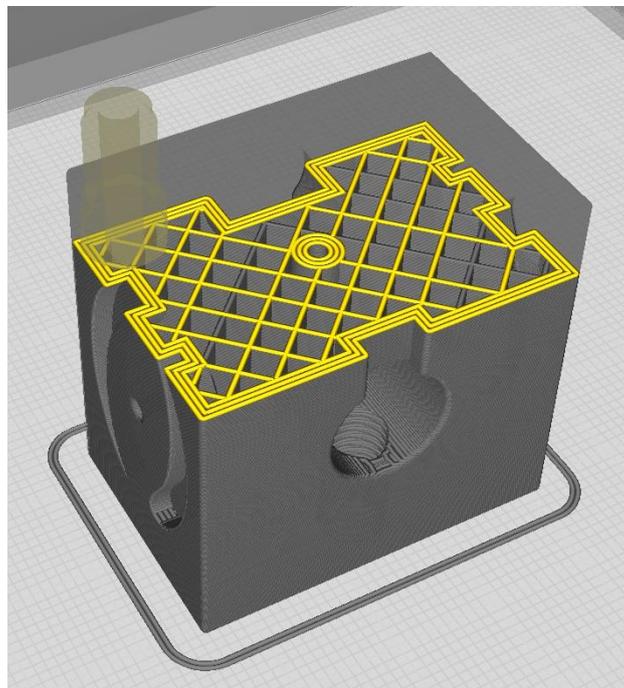


Bottom, left, and rear faces

The “metal” version of the block uses bored and counter-sunk grub screws in brass. Pressed-in hardened steel inserts were considered, but rejected as too costly. During development of the “metal” block, it was found that conventionally tapped holes in PLA plastic were too loose and would not hold a grub screw steady when a drill was applied. Instead, an M6 thread profile is 3D printed in 5 mm diameter holes, allowing the grub screws to be held accurately and firmly.

Construction

The blocks are 3D printed in eSun’s “PLA Plus”, a high temperature engineering filament with superior mechanical properties. The blocks are not tempered, and have a relatively low glass transition point of 50 °C. Pink was chosen as a colour likely to stand out on the workbench and shelf.



Section view of a block being printed showing honeycomb-like infill

As can be seen from the illustration above, blocks are not solid plastic, but have a honeycomb-like internal structure, while the external block walls and internal hole walls are triple thickness for additional strength.

The M6 brass guides in the “metal” block are (a) softer than steel guides, (b) have 1.5 Ø holes that are countersunk through the grub screw slot leaving it weaker than an intact slot, and (c) are a tight fit from the plastic deformation of the block’s threaded holes in which they are set. They have been inserted with a special driver bit.

Preparation

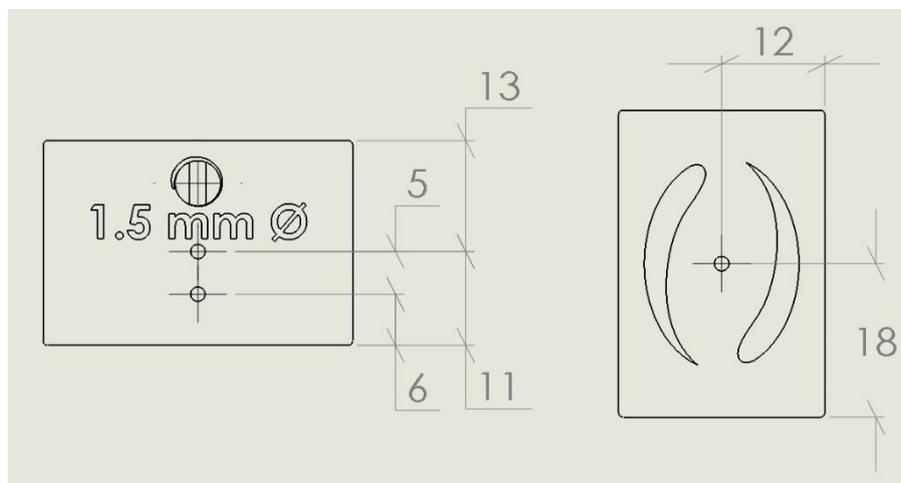
Before use, it will be an advantage to carry out some small checks as follows. To clean the guide holes of swarf or plastic over-print, run a 1.5 drill bit through using a pin chuck or pin vice (not a drill of any kind). Pass a scrap length of deburred or chamfered 11.0 or 11.1 spar through the central hole, the fit should be a very slight interference sliding fit, but neither a firm gripping fit nor such a loose fit that the block slides under gravity.

The guide blocks are best used on a spar which is new and bare. They will not slide over taped limit marks or any fittings already attached to the spar, and may not slide over holes which have carried fittings. If the mast will be pre-bent, it is recommended that this is done before any metal is cut.

Use

The blocks are designed to be used on a work surface without the need to be clamped in position, provided the drilling direction is perpendicular to the surface. Nevertheless, a block is rigid and strong enough to be clamped using a plastic-jawed "pistol grip" or spring-loaded clamp, but can and will be crushed by an over-tightened screw-thread clamp or vice. Metal jaws should be faced with rubber or cork.

The following diagram illustrates the relevant block dimensions. **Note** in particular that the "Forestay / Boom 1" hole is offset from the lock screw, and is not central on the block.



Face to hole dimensions

If holes larger than 1.5 mm \varnothing are required, such as for the Z-hook boom holes, use the blocks to create the 1.5 holes first and then, without using the block, enlarge the holes with the preferred size of drill bit. A 1.4 mm drill bit will work fairly well in the 1.5 guide holes. If a block with holes for drills smaller than 1.4 mm \varnothing is required, please contact the SAILSetc office.

A. Gooseneck to be fitted after drilling rigging holes

- 1 If the mast has had pre-bend added, or has any natural bend, find the axis of symmetry and mark it carefully.
- 2 Add one block to the lower end of the mast and lock in place with a light pressure such that the fore side is uppermost. The locking screw should be on the upper side.
- 3 Measure down from the top of the mast to the preferred locations of the drilling points and gooseneck location. Mark the drilling points in pencil. It may be helpful to also mark the expected position of the block on either side of the drilling points.
- 4 Place the mast and block on a large flat surface.
- 5 Position the second block at each drilling point in turn, taking care that the guide hole is over the drilling point and the locking screw is on the fore side. Lock in place. **Note** that the "Forestay / Boom 1" hole is 11 mm from one face and 13 mm from the other face. In turn, drill the required holes, turning the mast and locked blocks as required.
- 6 If working with a drill press rather than a hand drill or cordless drill, the block to be used for drilling can be placed on the drill table as required. The other block should be supported by a packing piece the height of the drill table.
- 7 After drilling the rigging holes, keep the mast locked in the block until the gooseneck has been marked in position as in Section C below.

B. Gooseneck already fitted

- 1 If the mast has already had the gooseneck added, use the first block to hold the mast with the fore side of the mast uppermost and with the lock screw on the upper side. Locate the gooseneck in the block, and lock.
- 2 Carry on from step 3 to step 6 above.

C. Marking gooseneck position

A gooseneck body with its attachment holes pre-drilled can be held in place by one or two blocks allowing the hole positions to be accurately marked on the mast for later drilling.

It is not recommended that the mast holes (or the gooseneck body attachment holes) be drilled while the gooseneck is held in place by any blocks. They have not been designed for that purpose and will fail to hold the gooseneck if its body is subject to drilling forces.

D. Sheeting holes in a boom

To drill a series of Z-hook holes in a boom, use the block holes labelled "Boom 1" and "Boom 2". These two are 5 mm apart. Having drilled boom holes using "Boom 1" and "Boom 2", slide the boom through the block so that the hole drilled using "Boom 1" is aligned with "Boom 2" and allow a 1.5 mm wire to drop into the hole. Drill the next hole using "Boom 1", and repeat, for perhaps 7 or 8 holes.

Modification

On a “metal” block, re-seating the grub screws should not be necessary, but if this is found desirable, it must be done with care. Even a slightly mis-fitting screwdriver is likely to fracture the relatively fragile slot in the brass and grind down the plastic threads of the M6 hole.

The guide holes can be opened, if desired, to a larger diameter.

On the “standard” all-plastic block the guide holes have triple walls, meaning that the 1.5 nominal diameter can be opened to a maximum of 2.05 mm Ø. When drilling out the PLA block, it is essential to place it in a drill press and hold it in position in a vice. Use a slow feed. The plastic is very “grabby”, and if an attempt is made to drill a hole out by hand while holding the block, it is highly likely that the drill bit will either seize or run through the hole uncontrollably and the attempt will fail, resulting in a ruined block.

On the “metal” block, the brass guides can be opened out following the above method, which is recommended, or the grub screw can be backed out, drilled out separately, and reinserted, which is not recommended.

On the “metal” block, a brass grub screw can be replaced, if desired, by a drilled M6 x 10 mm grub screw in stainless or high tensile steel. The replacement grub screw should be drilled before being inserted into the block. An attempt to drill out a stainless or hardened grub screw when in place in the block is likely to fail, since the 3D printed plastic softens above 50 °C and the threaded hole will promptly strip.

Lester Gilbert & Graham Bantock