

Ballast Pattern - Wing

For shallow draught classes

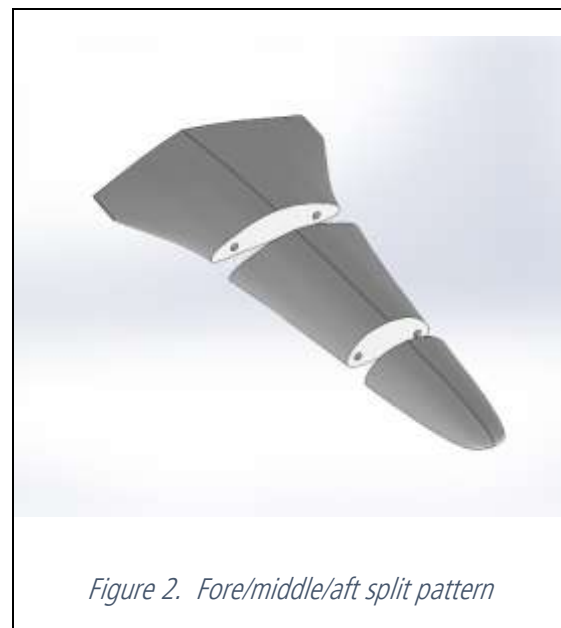
Introduction

The ballast pattern provides a form from which a cast ballast may be made. The pattern is supplied in kit form and requires assembly before use. The geometries available are:

Target finished casting weight	2, 2.5, 3, 8, 9, 10, 11, 12 or 13 kgs
Length/Diameter ratio:	Fixed
Width/depth ratio	Fixed
Split	Port & starboard halves for 2 – 10 kg Fore, middle & aft parts for 11- 13 kg

The pattern is 3D printed in eSun's "PLA Plus", a high temperature engineering filament with superior mechanical properties.

The 2 to 10 kg patterns have two components, one port and one starboard, as illustrated in Figure 1. The 11 to 13 kg patterns comprise three components, a fore, a middle and an aft part, as illustrated in Figure 2.



Scope of the patterns

The range of geometries available cover most of the normal requirements for bulbs of this type.

Heavier castings can be created, if required, by placing a spacer of an appropriate thickness between the port and starboard halves of a port/starboard split pattern. Note there is no possibility of creating a heavier casting in this way using a fore/middle/aft split pattern.

If the bulb you need cannot be produced from one of our standard geometry patterns, please ask, we may be able to help.

Preparation

The port and starboard patterns may be printed with a thin disc at each end, as illustrated in Figure 3, to ensure complete adhesion of the print to the build plate and avoid any warping. In this case, the disc material will need to be carefully cut away. It is recommended this is done in step 5 or step 10 as applicable.

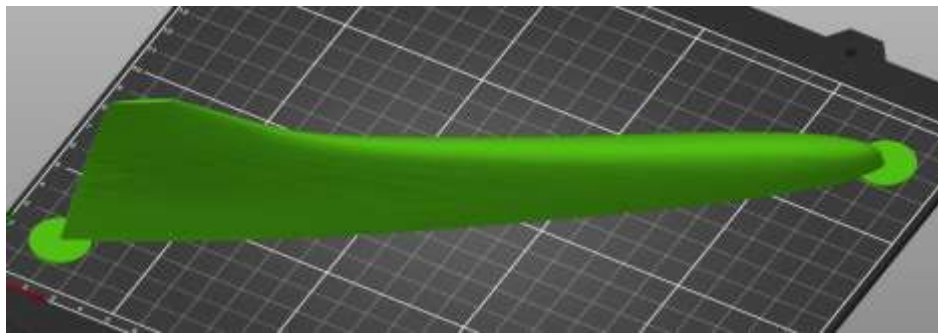


Figure 3. Pattern printed with anti-warping discs

Check the surfaces of the printed parts for any irregular upstanding roughness, and remove using 80 or 100 grade abrasive paper. PLA is best sanded wet and relatively slowly. Local heat build-up during sanding does not dissipate very quickly, softening the plastic and then clogging the sandpaper.

Check that the locating holes in the matching surfaces will easily accept the metal locating pin(s) supplied (12 mm length(s) of ¼" Ø aluminium alloy tube). Remove any obstructing fibres. Check the edges of the pin(s) and smooth away any burrs.

Assemble a port/starboard split pattern by following the steps of Section A, or the steps of Section B for a fore/middle/aft split pattern. Epoxy is recommended for bonding PLA thermoplastic, as is any other specialist glue formulated for this application.

(A) Port/starboard split patterns – 2 to 10 kgs

You need the following materials:

- Epoxy resin and thickener, or epoxy glue, and applicator stick/brush

- Flat surface large enough to lay the pattern parts onto while the glue sets
- Sheet of polythene or other plastic used to cover the flat surface to provide a non-stick layer
- Straight edge, pen
- Single or double-sided self-adhesive tape, rubber bands

Follow steps 1 to 5, and then 6 to 10 to make a pattern that allows a spacer of an appropriate thickness between the port and starboard halves. Follow steps 1 to 5, and then steps 11 to 16 to make a pattern whose halves are bonded together.

Where the pattern will be used in two halves

Using the pattern in two halves may be preferred in order to permit using a spacer to adjust the cast weight up from the nominal target, to make the casting process easier, or to cast the ballast in two halves.

Where the pattern will be used in one piece

The following steps bond the starboard part to port part using the alignment pins.

- (1) Place the 3 locating pins into the holes in the port half of the pattern. Trial fit together the starboard part by adding to the port half. Remove any excess material interfering with their fit. Separate the parts.
- (2) Mix sufficient epoxy resin to bond the parts together. Apply epoxy to the mating surfaces and assemble the parts. Use rubber bands or tape to hold the parts together taking care to align them correctly.
- (3) Remove excess resin/glue taking care not to disturb the alignment.
- (4) Set a timer/alarm clock reminder to check the parts after 1 hour at 20 °C, or after 2 hours at 15 °C. As before, part cured epoxy is easier to remove with solvent (acetone). Make a clean joint, checking and adjusting alignment and fit as required. Allow to fully cure, preferably overnight.
- (5) Abrade away any excess epoxy. **Proceed to the finishing stage, step 10.**

(B) Fore/middle/aft split patterns – 11 to 13 kgs

You need the following materials:

- Epoxy resin and thickener, or epoxy glue, and applicator stick/brush
- Self-adhesive tape

The fore part is bonded to the aft part using the locating pin to align the parts.

- (6) Trial fit together the fore, middle and aft parts by placing the locating pin into the holes provided. Remove any excess material interfering with their fit.
- (7) Mix sufficient epoxy resin to bond the parts together. Apply epoxy to each mating surface and then assemble the parts. Press the parts fully towards each other. Remove excess resin/glue taking care not to disturb alignment and fit. Use small tabs of self-adhesive tape to maintain the correct relationship between the parts.

(8) Stand the assembled parts somewhere safe where excess epoxy can drip without causing a problem.

Set a timer/alarm clock reminder to check the parts after 1 hour at 20 degrees C, or after 2 hours at 15 degrees C). When the epoxy is part cured it is easier to remove excess with solvent (acetone) and make a clean joint. Check and adjust the alignment as required. Allow to fully cure, preferably overnight.

(9) Remove the self-adhesive tapes from the pattern. Abrade away any excess resin/glue that adheres to the surface of the pattern. Proceed to the finishing stage, step 10.

Finishing the pattern

(10) The pattern is intended for use with the sand casting process. The surface finish will probably be perfectly satisfactory to use as it is but it will be slightly easier for the foundry to use the pattern if you prepare a super smooth surface as follows.

You need the following materials:

- Primer spray paint
- Polyester filler
- Double-sided tape for a pattern with separate halves and optional spacer

A pattern with separate port and starboard halves requires the two halves to be held together during finishing, including any spacer required. A low-tack double-sided tape is recommended.

(11) Wrap 180 grade grit paper around a hard block of plastic, wood, or metal. Abrade the pattern surface all over, using water as a lubricant and coolant. Aim to make the surface fair, removing any major irregularities - it is not necessary to achieve a homogenous finish all over. Allow to dry.

(12) Spray the pattern all over using a primer spray paint (*). Hang the pattern for a better covering rather than spraying it on a flat surface. Allow to dry.

(*) Check that the intended primer is suited to PLA thermoplastic, the pattern may need degreasing first with isopropyl alcohol (IPA).

(13) The primed surface will reveal any hollows/blemishes making it easy to fill them using a polyester paste. Mix the polyester filler and apply to the hollows. Avoid over filling – several applications will be needed anyway and it will be easier to abrade each time if too little rather than too much is applied. Allow to cure.

(14) Wet abrade using 180 grade grit paper all over. Allow to dry.

(15) Repeat steps 23 & 24, and possibly step 22, until you have a blemish free surface.

(16) Wet abrade using 400 grade grit paper, dry, and give a final coat of primer spray as per step 12.