

# HOW TO MAKE A MOTOR BRACKET

## HOW TO MAKE A MOUNTING BRACKET FOR AN ELECTRIC MOTOR

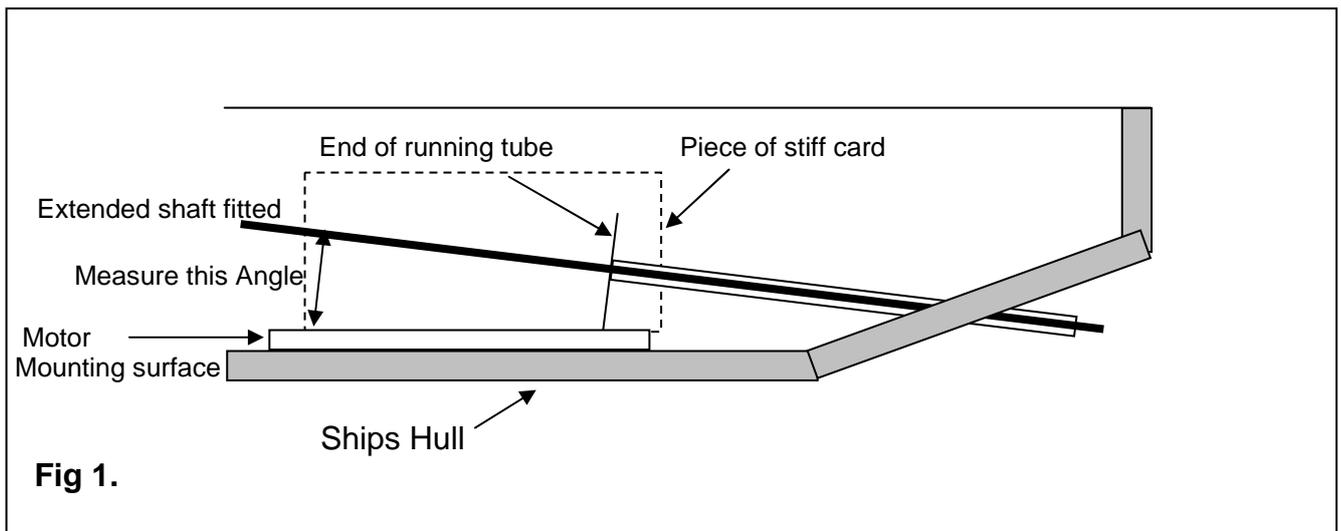
Often, brackets supplied with purchased items (e.g. electric motors or servos) are not ideally suited for fitting into our models or they are not supplied at all. This short article describes how to design and make simple mounting bracket for an Electric Motor in order to fit it into a model boat.

### PART 1 - BRACKET DESIGN

Let us assume that the boat hull has been made and the propeller shaft installed, the electric motor and flexible coupling have been chosen and are available e.g. (Graupner speed 400 motor with a Raboesch single Coupling).

#### ***Boat Measurements***

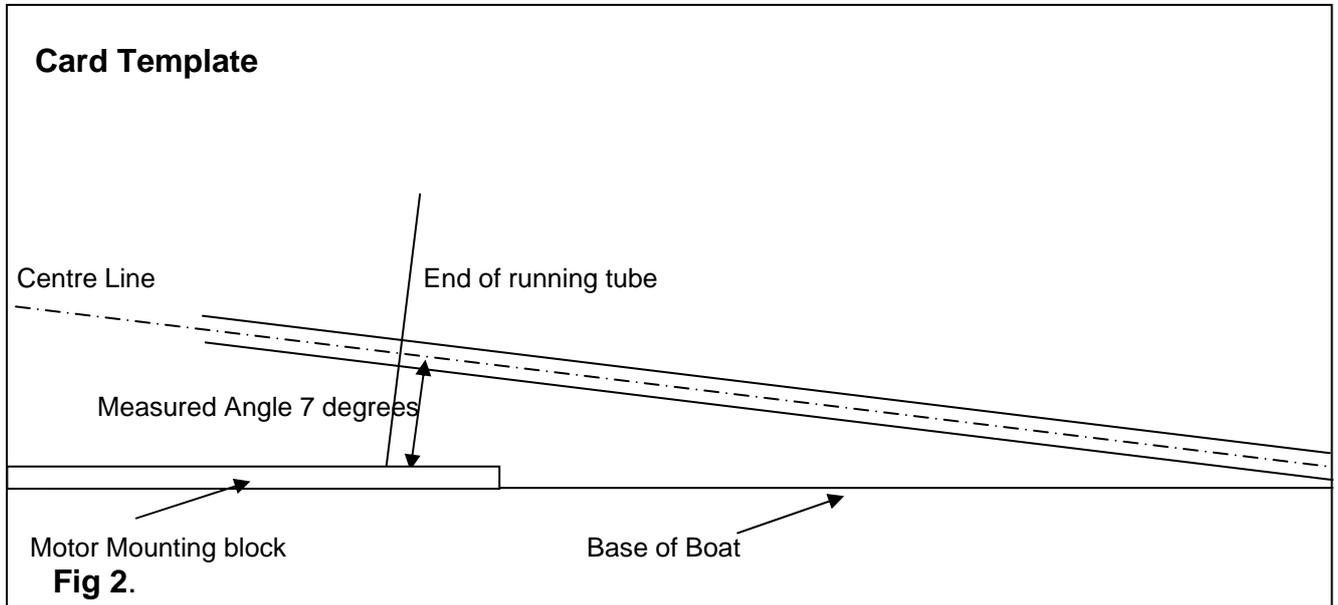
Our starting point for the bracket design is to make some basic measurements of the boat construction and ascertain the mounting arrangements for the electric motor, in the example a mounting surface has been provided in the bottom of the boat, see Fig 1.



Measure the angle/dimensions of the propeller shaft in relation to the mounting surface in the bottom of the boat where the motor bracket is going to be fitted. In order to ascertain this angle, place a piece of stiff card, (to be used as a template) behind the propeller shaft/Running tube and draw a line along the shaft (both top and bottom) where it forms an angle to the mounting surface, also mark the card at the end of the running tube, see Fig 1.

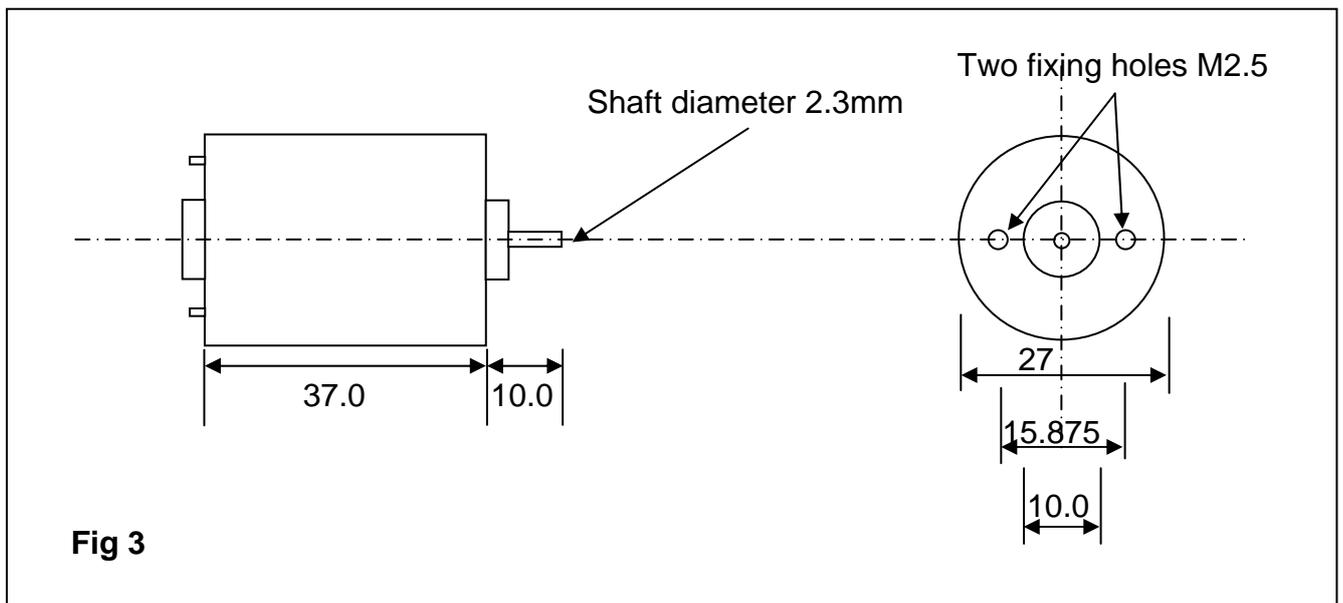
Remove the card from the boat and draw a centre line through the top and bottom lines previously drawn on the card. Using a protractor, measure the angle on the card between the motor mounting surface and the centre line drawn for the propeller shaft, see Fig 2. In the example the angle is 7 degrees.

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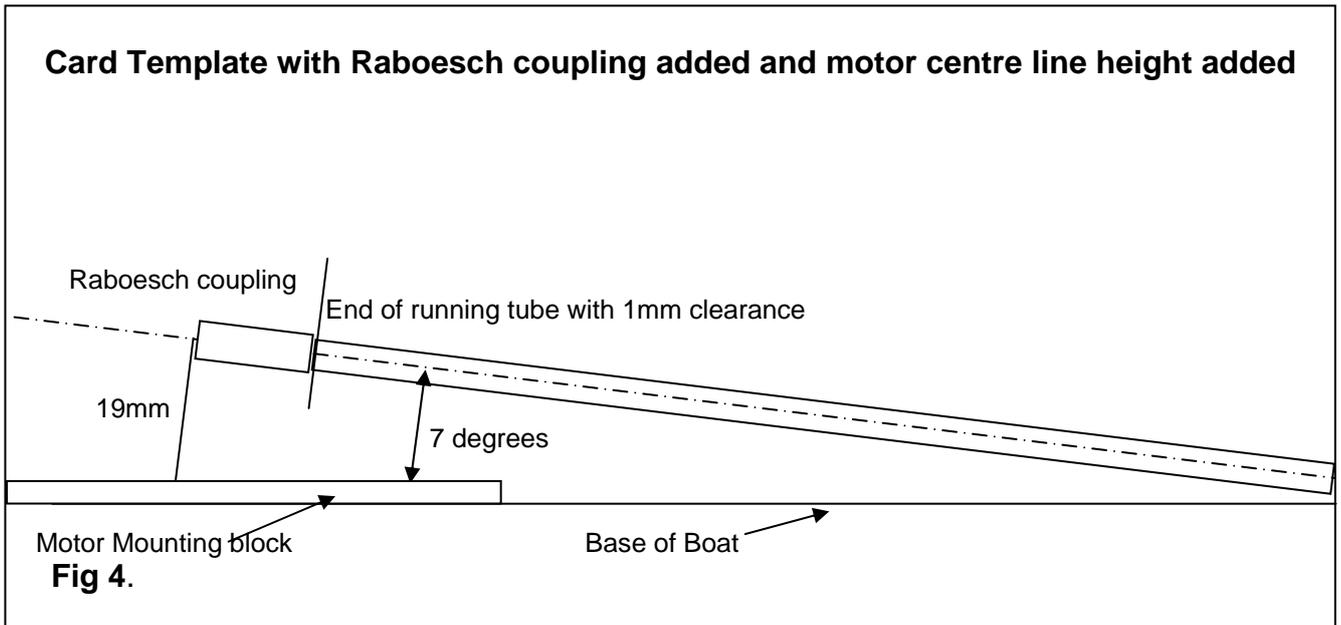


## ***Motor Measurements***

Now measure the motor, its size and mounting arrangements, the 400 series motor mentioned above is as shown in fig 3.



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Now we have all the information to create our bracket design and drawing, prior to making the bracket.

### ***Bracket Drawing***

Let us consider the above measurements, in order to create our working drawing.

- |  |                          |
|--|--------------------------|
| a) Distance from hull base to shaft centre line  | 19mm                     |
| b) Motor overall diameter                        | 28mm                     |
| c) Motor main body length                        | 37mm                     |
| d) Motor boss diameter around output shaft       | 10mm                     |
| e) Shaft angle and therefore motor bracket angle | 7 degrees                |
| f) Motor fixing screws (on shaft face) 2 x M2.5  | 15.875mm between centres |

**From the above information we can arrive at the overall size of our bracket as follows.**

Width of motor bracket	Diameter of motor	28mm
Allowance for fixing screws	In the Base	10mm
	<b>Minimum Width</b>	<b>38mm</b>

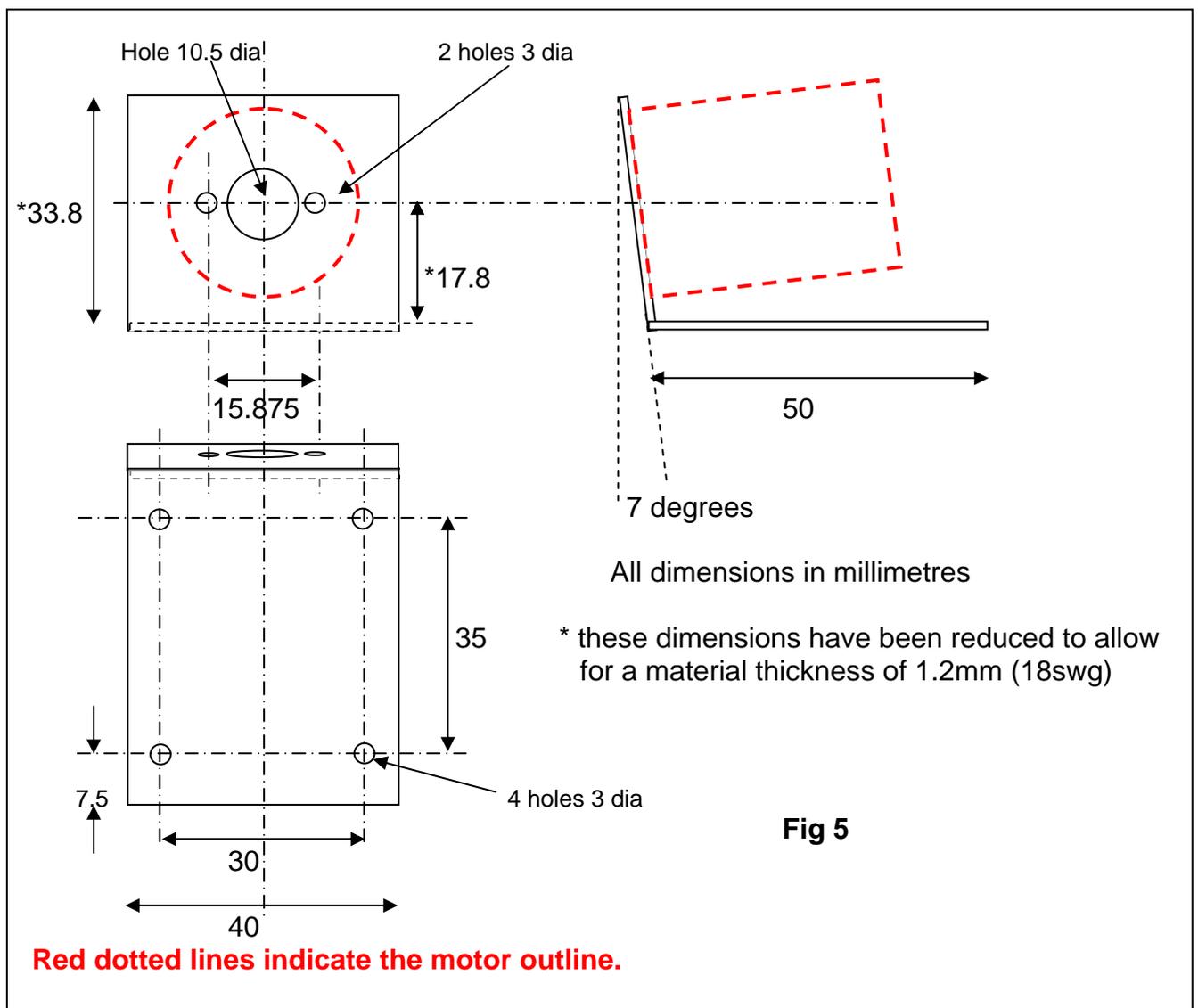
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Height of bracket	Height to centre line	19mm
	Half diameter of motor	<u>14mm</u>
	<b>Minimum height</b>	<b>33mm</b>
Length of Base	Length of motor	37mm
Allowance for support	In Base	<u>10mm</u>
	<b>Minimum length</b>	<b>47mm</b>

Taking all the above measurements into consideration and rounding them up, we can arrive at the following overall dimensions

**Width 40mm,                      Height 35mm,                      Base Length 50mm**

We are now in a position to draw up our bracket design; the final drawing is shown in fig 5



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## PART 2 - BRACKET MANUFACTURE

### ***Materials***

Before commencing manufacture we should consider the types of material available that we may wish to use, these are mainly Aluminium, brass or ABS. The material needs to be about 1.2mm thick (18swg)

My personal favourite is aluminium, this is because it is light and easy to work with, but brass is also good choice as it provides a nice shiny finish if its surface is protected during the manufacturing process and the finished article will look good in any boat.

ABS is really only suitable for very small motors and should be heated in hot water when bending to avoid fracturing when bending.

### ***Marking Out***

The following tools are recommended for the manufacturing operation, although being model makers we have learnt to adapt the use of other tools where and when necessary.

The tools are: -

Small Square, Centre Punch, Scribe, 150mm Steel Rule, Drills, Hack Saw, Files and a Vice.  
A picture of some of the items is shown in fig 6.

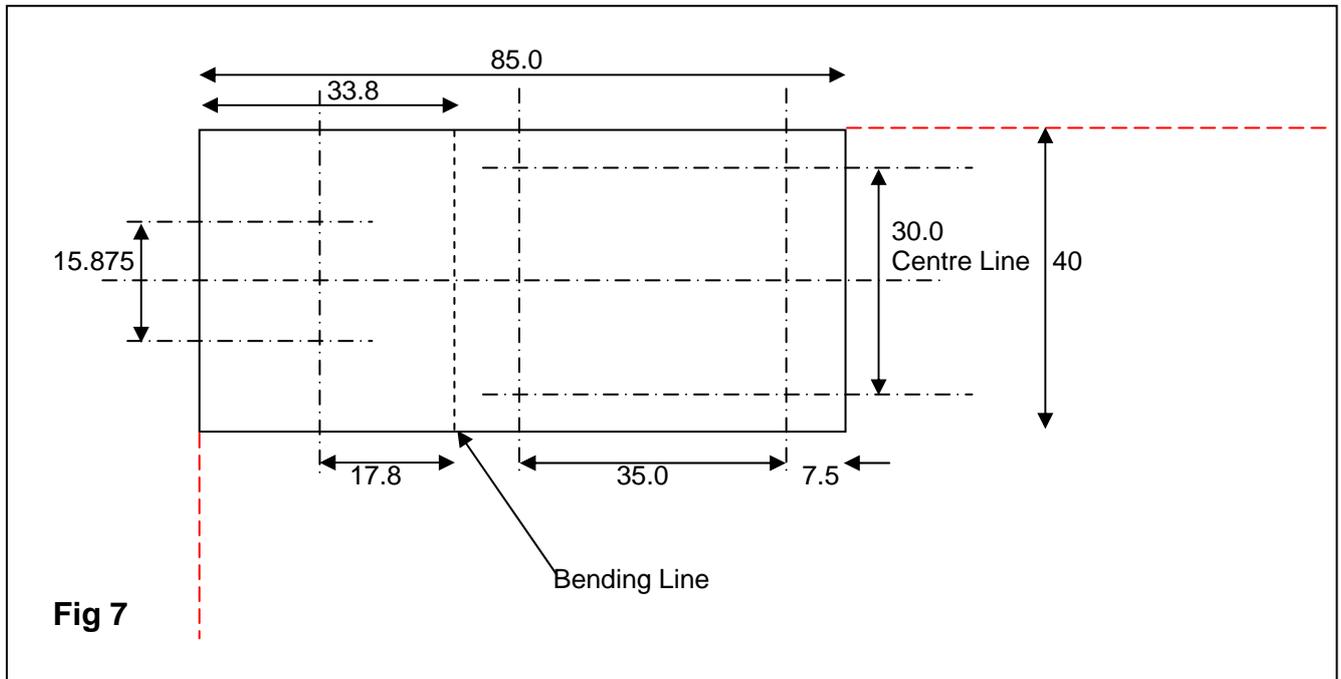


**Fig 6**

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Initially mark out the total size of the bracket; the bracket height is 35mm plus the length of the base 50mm, giving a total length of 85mm and a width of 40mm. The developed and marked out material is shown in fig 7.

If you have two nice edges to your sheet of material that are at right angles, these may be used to form two of the sides for the bracket which are shown in red on the drawing in fig 7. Note that some dimensions are centred equally on the bracket centre line.



Mark out the bracket as shown above in fig 7 using the Square, Rule and Scriber shown in fig 6, when this has been completed, lightly and carefully centre punch all the centres of the holes in preparation for drilling, making sure that you centre the punch exactly on the intersection of the scribed lines.

If the sheet of material on which you have marked out the bracket is small then it is better to go ahead and drill the bracket before cutting it out of the sheet, as a larger sheet is easier to handle, on the other hand, if you consider it too large, then follow the cutting out instructions, described later in this article before going ahead with the drilling.

### **Drilling**

Initially select a small drill of say 1.5mm diameter (this is known as a pilot drill) and carefully drill each of the centre punched marks (make sure that you drill exactly in the centre of the punched hole).

Select a 3mm diameter drill and open up the seven holes previously drilled.

Remove the burrs from the drilled holes by selecting a larger drill of say 6mm and spinning the drill in the holes by hand (on both sides the metal sheet).

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Open up one hole for the large boss of the motor as shown on the drawing in fig 5. This must be done carefully and if a 10.5mm drill is used the metal sheet must be clamped to the work bench before drilling for if the large drill snatches at the sheet of material it will rotate and may cause an accident.

An alternative method is to open out the hole to say 4 or 5mm and then use a Cone Drill to increase the diameter of the hole to 10.5mm. A set of Cone Drills is shown in fig 8

When this has been done, the bracket will be ready for cutting out.



**Fig 8**

### ***Cutting Out***

Using a Hacksaw cut the bracket out of the sheet of material, cut just outside of the scribed lines, when this has been completed, place the bracket in a vice (protect the jaws so that the bracket material is not marked) and file down to the scribed lines. Use the file to remove the burrs by running along the filed edges at 45 degrees.

### ***Cleaning***

Using either fine wire wool or fine wet/dry paper, rub all over the surface of the bracket on both sides, this should finally be done using a circular motion which will give a good key-way for painting. Wash the bracket in warm water and dry off using a tissue.

Inspect the bracket and check that there are no burrs left on its surface (both sides). Can the bending line still be seen? If not, re-scribe the line so there can be no mistake as to where the bend is to be made.

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### ***Bending***

Place the bracket in a vice (protect the jaws so that the bracket material is not marked) and slide the bracket material down so that the scribed bending line runs along the top edge of the vice jaws. Check that the bracket material is at right angles to the vice jaws by placing the small square on top of the vice and along side the bracket, adjust as required.

Using a piece of scrape clean material (e.g. thin ply), place this behind the part of the bracket that is protruding above the vice jaws and pull it over to form the bracket. Remember it needs to be set at an angle of 7 degrees. Initially this will be estimated but finally remove the bracket from the vice and measure the angle using either a combination set or a drawing protractor, adjust the angle to suit. The basic bracket manufacture is now completed.

### ***Trial Fitting***

Now the moment of truth, using two short pan head screws of about 6mm long with plain washers under the heads, loosely fit the motor to the bracket. With the propeller shaft and coupling installed, offer the motor/bracket assembly to the shaft. There is some adjustment of the motor within the bracket (the motor fixing holes are oversize) also by moving the bracket/motor assembly towards bow or stern of the boat, the shaft to motor alignment may be adjusted to achieve perfect alignment.

Run the motor at a slow speed to ensure the alignment is satisfactory, and then mark the fixing holes on the motor mounting block within the boat through the bracket fixing holes. Remove the motor/bracket assembly.

Mark the centres of the motor bracket fixing holes using a sharp pointed tool (e.g. bradawl) and drill four small pilot holes into the motor mounting block (make sure you do not drill through the bottom of the boat). Screw in four suitable screws into the base to pre-form the screw threads, then remove the screws and fit the motor and bracket and screw into position, run the motor and align as required to verify satisfactory running.

### ***Painting***

If it is required to paint the bracket, the motor/bracket assembly should be removed from the boat and the motor removed from the bracket. Mask the two motor fixing holes on the bracket where the heads/washers of the fixing screws will be. (This will ensure that the bracket is earthed to the motor when it is finally fitted).

Paint the bracket using first an undercoat and then finally a suitable topcoat. It is recommended to use either an aerosol spray or an airbrush for best type of finish. Allow the paint to thoroughly dry before final fitting.

### ***Final Fit***

When the bracket has been painted and is thoroughly dry, re-assemble and refit the bracket/motor assembly into the boat. Re-align the motor/bracket assembly as required and test run the motor to verify the alignment is satisfactory.

***YOUR BRACKET PROJECT IS NOW COMPLETED***

Tony Dalton