

**Miniature Steam Pty Ltd.**

Bringing the Highest Quality Standards to Model Engineering



***“Miniature Steam”* Steam Plant Kit**  
for self-assembly in  
**Caldercraft “Northlight” -Clyde Puffer**  
**2” Vertical Boiler with**  
**“Avon” Twin Cylinder Oscillating Steam Engine**  
**Kit Assembly Instructions**



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## Caldercraft "Northlight" With "Miniature Steam" Custom Steam Plant

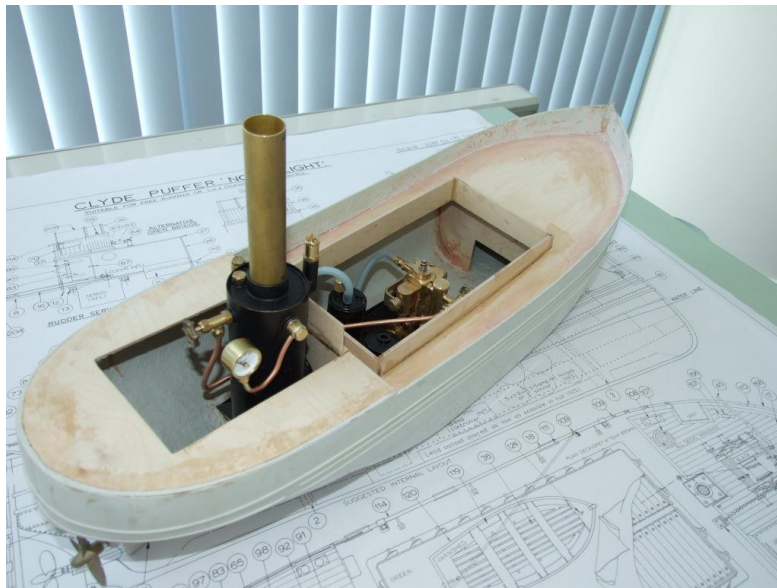


Fig.1

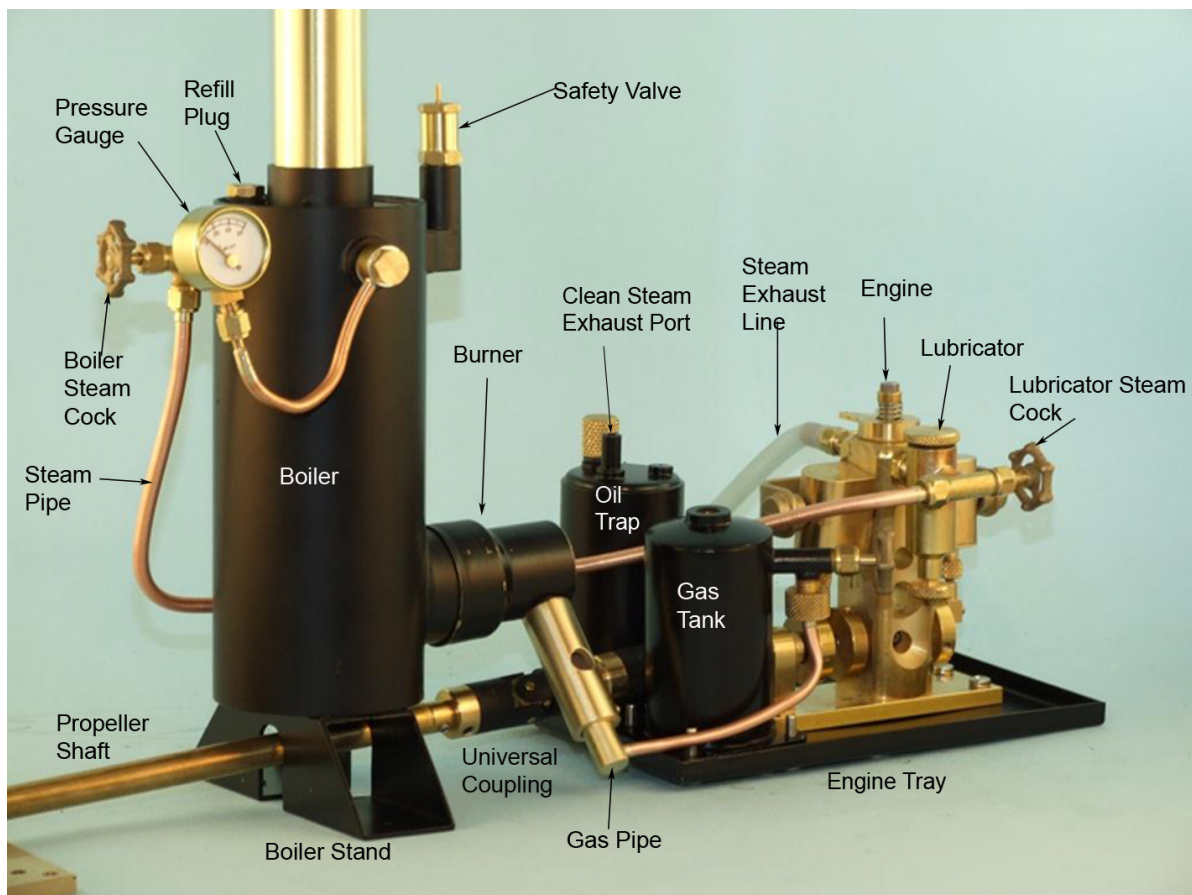


Fig.2

The position of the boat superstructure and boiler exhaust flue at the stern of the hull required the engine to be fitted forward of the boiler, while still delivering power to the propeller at the stern. As illustrated in the picture, this is accomplished by mounting the boiler on a stand that allows the propeller shaft to pass under the boiler. When the installation is complete the engine is accessed by removing the forward hatch cover and the boiler accessed by lifting the superstructure. Cleaned steam from the oil trap is discharged through a port on the side of the hull as indicated.

Note: The above picture shows a Boiler Steam Cock. This is no longer fitted. The steam line connects directly into the boiler. All steam line control is effectively made by the Lubricator Steam Cock. Also the Boiler Stand supplied is simpler than the one shown. There is no change of function.

## **Assembly Instructions:**

The following items are required:

1. Refillable gas tank P/N 4271
2. 2" Vertical boiler P/N 4057
3. 2" Ceramic burner P/N 4264 & control valve P/N 4025
4. Oil trap P/N 4062
5. "Avon" Oscillating engine self assembly kit P/N 5027K or fully assembled engine P/N 5027
6. Accessories: Mounting trays, steam pipe, pipe fittings, mounting screws etc.: P/N 5036
  - \*45 mm propeller P/N 1069M,
  - \*Custom propeller shaft assembly P/N 5358,
  - Mounting tray mounting block P/N 3003,
  - Engine mounting tray P/N 2846,
  - Boiler stand P/N 2847,
  - Special twin universal joints assembly P/N 2313
  - Steam pipe P/N 3022,
  - Gas pipe P/N 3023,
  - Exhaust port brass fitting P/N 5701
  - Mounting screws kit. P/N 2320
  - Silicon rubber tubing P/N 2307
  - Special flue P/N 3036

NOTE: Items marked with \* are to be used in place of the standard items supplied with the individual kits, which should be discarded.

### **Step 1. Assemble the mounting tray mounting block:**

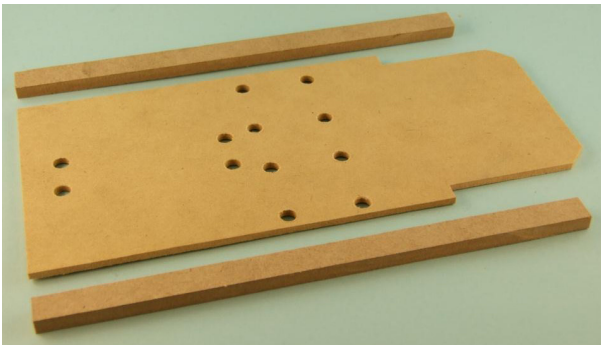


Fig.3

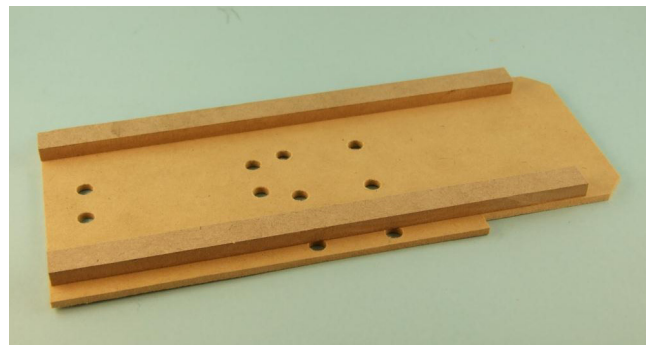


Fig.4

Glue the spacers to the mounting tray as illustrated using a two pack epoxy glue. The rails are 10 mm x 6 mm and the glue should be applied to the 10 mm surface. When the glue has set it is recommended that the assembly be given a coat of varnish to seal the wood against the oil and water that accumulates under an engine tray during operations. While the glue/varnish is drying proceed as follows:

For older models that have a solid stern bulkhead, mark out an area 60mm high and 95mm wide centered on of the bulkhead, to be cut out to allow for insertion of the mounting tray mounting block as illustrated in Fig.5 Trim the marked out area from the bulkhead with a Dremel, Proxon or other trimming tool. On more recent models this clearance hole has been cut during manufacture of the boat components. Check that the mounting block can be fitted as illustrated in Fig.5 and make adjustments as necessary.

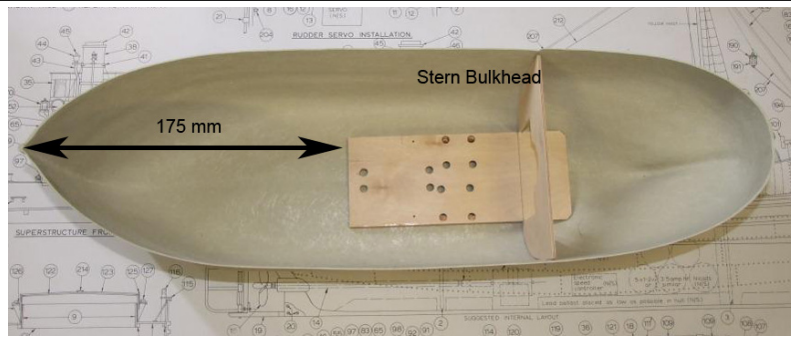


Fig.5

## Step 2. Layout the screws supplied in the Accessories

There should be at least 4 wood screws for securing the tray and the boiler stand to the mounting block; 4 x 6 mm screws and nuts for securing the oil trap to its tray, 2 x 3 mm screws to secure the boiler to its stand and 4 x 12 mm screws and nuts to establish a removable fixing for the gas tank. With the exception of the latter it is recommended that the screws be inserted from the top of the tray with the nuts on the underside of the tray. (We have supplied extra nuts or screws—just in case some get lost!)

## Step 3 Fix the Gas Tank Mountings.

The gas tank is attached to the mounting tray to secure it during transport. These screws should be discarded and the nuts used for the new 12mm screws to be used. The 12mm screws for the gas tank should be inserted from the underside and the nuts tightened from the top before placing the tank on the screw ends (see Fig.6 & Fig.7 following). This provides for easy removal and reinsertion of the tank during refilling operations. Filling instructions are detailed in a facts sheet supplied with the tank.

***DO NOT EVER BE TEMPTED TO REFILL THE TANK WHILE IT IS IN POSITION  
IN THE BOAT—YOU RUN A SERIOUS RISK OF TRIGGERING AN  
EXPLOSION WHEN RESTARTING THE BOILER.***

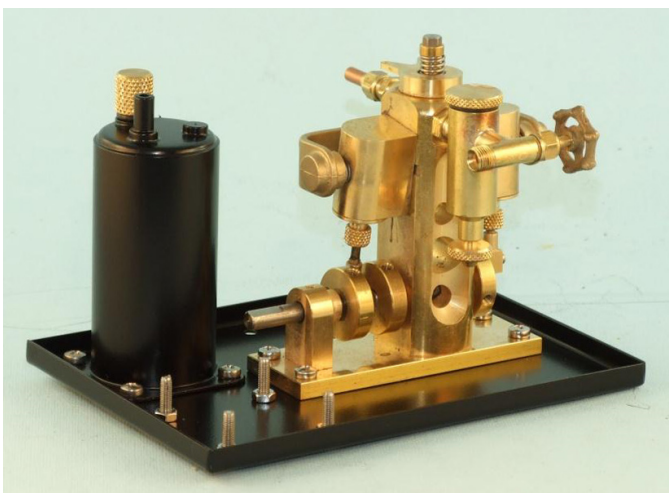


Fig.6

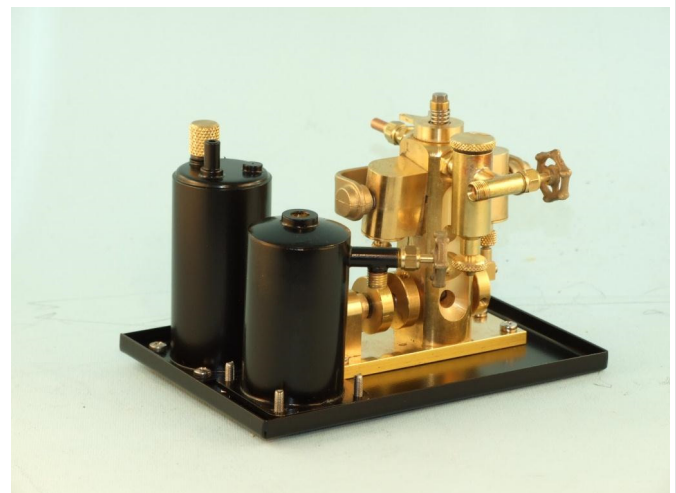


Fig.7

#### Step 4 Assemble the engine mounting tray. (See pictures above)

The mounting tray is supplied with the engine and oil trap fitted. Please check that the nuts on the securing bolts are firmly tightened and the engine turns over freely.

Assemble the engine as set out in separate instructions supplied with the engine kit if you are using a self assembly version of the engine. With either the self assembly version or a fully assembled version, fit the engine to the tray as illustrated above using the 4 x 8 mm screws supplied. Make sure the engine is rotating freely before **and after** screwing it to the tray. If there is any uneven tightening of the screws the engine may stiffen and no longer run efficiently. The same caution applies to fitting the engine mounting tray to the mounting block later.

Secure the oil trap to the tray with the 4 x 6 mm screws and cut a length of silicon rubber tube to neatly connect the steam exhaust line between the engine and the oil trap.

Position the gas tank on its four studs as illustrated in Fig.7.

#### Step 5. Starting up the plant:

A separate document “**OPERATION OF “*Miniature Steam*” OSCILLATING STEAM ENGINES**” is included to guide commissioning of the plant. This is a document that advises general background information for building and operating a “*Miniature Steam*” plant.

The following pages have specific instructions for this steam plant..

**Step 6 Commissioning** This is best done using the mounting tray mounting block as illustrated below before finalising the fitting of the assembly in the boat hull.

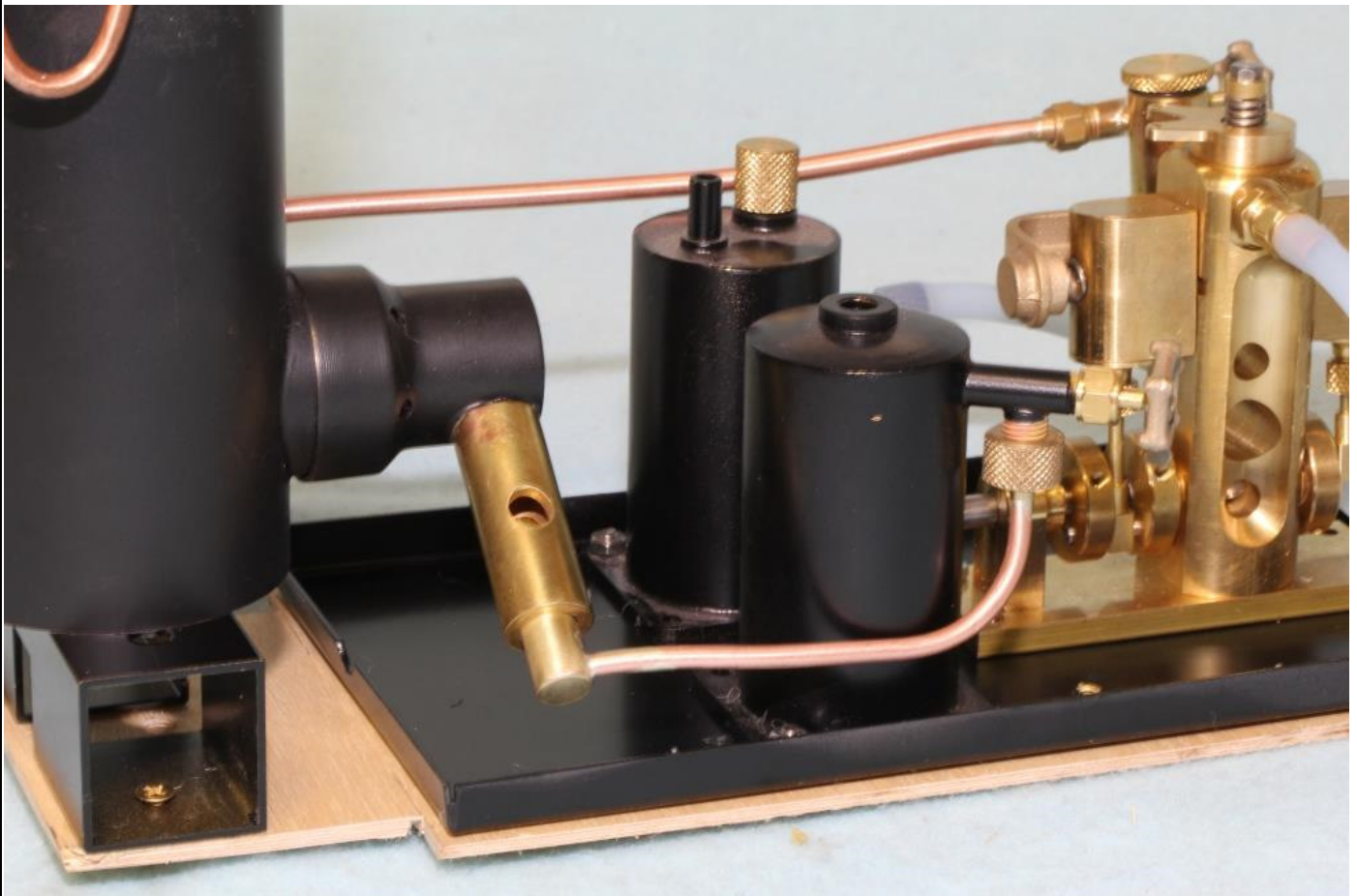


Fig.8

Screw the boiler to its stand and stand it (do not screw it down just yet) on the end of the mounting tray mounting block as illustrated in Fig.8 . Place the assembled mounting tray on the mounting block and connect the steam line and gas line & burner to both units as shown. The tray should settle nicely on the mounting block with the underside bolt heads fitting onto the holes drilled in the mounting block. This sequence enables correct positioning of the boiler on the mounting block.

Using the wood screws supplied, lightly screw the boiler assembly to the mounting block. Do not install the propeller drive train at this time. This should be done after installation in the boat hull.

~~Fill the gas tank and calibrate the ceramic burner as per the instruction sheet supplied.~~

## 7. Running the Boiler

- Remove the refill plug on the top of the boiler, and using the syringe supplied, fill the boiler with clean water to approximately 75% of full volume. The water level in the water level sight glass should be visible close to the top. Make sure you can see the water level in the sight glass. The boiler requires space above the water level to accumulate steam; if you can't see the actual water level remove some water with the syringe until you can. Replace the refill plug and lightly tighten.
- Check that the steam stop cock on the boiler is closed.
- **If the boiler is cold**, remove the gas tank from its mounting pins and the burner from the boiler. With the gas line from the burner to the gas tank still connected, open the gas valve a little. Light the burner directly with a gas gun (illustrated below), reinsert the burner into the boiler while it is burning and replace the gas tank onto its mounting pins. Ensure the knurled nut connecting the gas pipe to the gas tank is firmly tightened before opening the gas valve fully.
- **If the boiler is warm**, open the gas valve a little and hold a gas gun ( pictured below-NOT a lighted match or the sparking type of gas gun) to the top of the stack. When the burner ignites, open the gas valve fully. It can seem noisy but this is normal. The boiler should reach its maximum working pressure of 40 psi (2.8 bar) in about 5 to 6 minutes. If it is filled with warm water this time can be reduced to 3 to 4 minutes. When the pressure gauge reaches recommended operating pressure, adjust the steam cock on the lubricator to allow some steam to flow through to the engine to heat the steam pipe and the engine cylinders. When these are cold some condensate will blow out of the engine when the steam reaches the cylinders. This is normal.

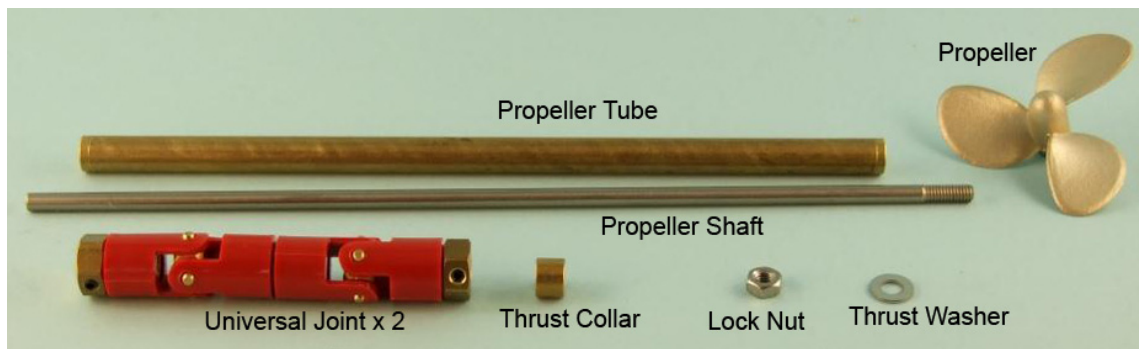


- Adjust the lubricator steam cock to produce the power required for running the engine on the bench. If the safety valve blows off at operating pressure (see above), after the engine reaches the desired operating speed adjust the gas valve to reduce the gas supply as well.
- Note that in the early stages of running up the boiler, the rate of gas consumption will cause the gas tank to cool down – possibly to the point where frost will appear on the outside of the tank. This is normal and in practice will cause a reduction in burner performance at the time. Don't worry – the gas tank is mounted close to the boiler and it will soon warm sufficiently to keep the tank delivering maximum gas to the burner.
- To stop the boiler, turn off the gas cock and wait for the steam pressure to drop to zero before closing the boiler steam cock ready for the next run. The lubricator steam cock should remain as set to provide the same operating power on the next run.

Before fitting the assembly in the boat hull run the plant for at least six boiler fills to remove any stiffness in the engine. This is a good opportunity to practice controlling the engine speed and boiler power adjustments. At the end of each run drain and refill the displacement lubricator, refill the gas tank and boiler and mop up any loose oil or water that may have accumulated on the board/tray. This should become a routine for all runs after installation in the boat.

### Step 8: Assemble the propeller drive train:

The propeller drive train should be assembled and partially installed before commencing installation of the plant in the boat hull. Please note that the propeller shaft and tube come as an assembly and should not be dis-assembled unless there is a specific need.



If working with a new boat kit the standard propeller shaft assembly should be discarded and replaced with the propeller shaft and propeller supplied with the steam plant kit.

For new hulls, drill a hole in the stern of the hull as per the boat assembly instructions to enable the fitting of the propeller tube/shaft. For retro-fitting the steam plant to an established boat it is recommended that the existing propeller shaft be removed and replaced with the components as pictured above and described below.

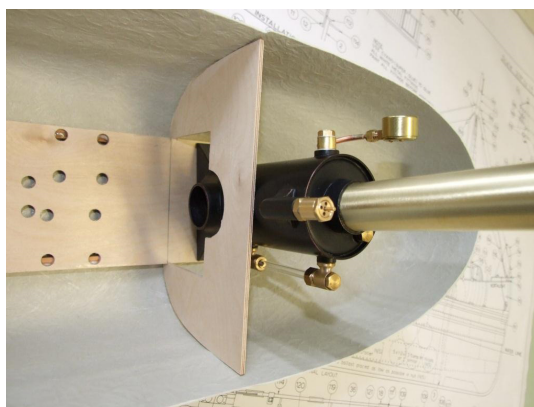
Slide the thrust washer onto the threaded end of the propeller shaft followed by the lock nut and then thread the shaft into the propeller as far as it will freely go. Tighten the lock nut against the propeller hub to secure the propeller to the shaft. Insert the propeller shaft assembly into the hull and slide the thrust collar onto the other end of the propeller shaft inside the hull. Lightly secure the propeller shaft by the grub screw in the universal joint with the smaller bore. (the propeller shaft is 4 mm diameter and the engine drive shaft 5 mm diameter). The other connection of the engine drive shaft to the universal will be done after the boiler assembly and engine tray are installed in the hull.

### Step 9: Fit the engine tray assembly & boiler in the boat hull:

Disconnect the steam line and burners assembly from the boiler and remove the boiler & stand from the mounting bloc.

Run 2 pack epoxy on the mounting block rails (see Fig.4), and fit the mounting block in its correct position, as shown in Fig.4) with the mounting tray still fitted. Allow time for the epoxy glue to set.

When ready fit the boiler and stand as it was setup when running in with the steam line and gas line connected to the boiler. Secure the boiler stand to the mounting block with the wood screws supplied.



### Step 10 Fitting the propeller drive train:

Slide the propeller drive train forward so that the front universal joint fits onto the engine drive shaft. Lightly tighten the universal joint grub screw onto the flat that is machined on the engine drive shaft.

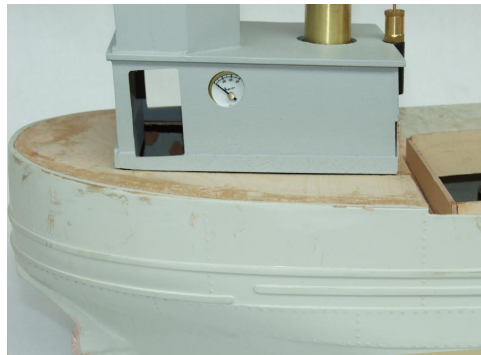
Holding the fully assembled engine tray block in one hand and the propeller in the other, rotate the propeller to sense the alignment of the propeller shaft assembly. When the assembly is correctly aligned the engine and propeller shaft should rotate smoothly without sign of "run out" in any component of the assembly.

Fill the boat hull/drive shaft cavity with motor body epoxy filler and as it sets continue to check for smooth rotation of the drive train assembly. Make small adjustments as necessary before the filler sets.

Fit the steam exhaust nipple into the hull on the left side of the hull facing forward 55 mm below the top edge of the hull and 40 mm forward of the bulkhead as pictured. Neatly fit a length of silicon rubber tube between the nipple and the oil trap exhaust port.



When the boiler is secure, bend the pressure gauge siphon to a position where the gauge can be neatly seen through the hole in the superstructure as pictured.



Before installing the deck, fit all the RC components in place (battery, servos & links, & wiring ), and conduct a buoyancy balance test. Glue appropriate ballast in positions to provide even displacement of the loaded hull. Some fine adjustments can be made later but it is better that this process is undertaken before gluing the deck in place as per the boat assembly instructions.

When the deck glue is set you are ready for steaming trials.