

**Miniature Steam Pty Ltd**

Bringing the Highest Quality Standards to Model Engines



## ***“Miniature Steam”* Steam Plant Kit**

for self-assembly in

**Caldercraft “Joffre” -Tyne Tug**

**2” Horizontal Boiler**

**with**

**“Avon” Twin Cylinder Oscillating Steam Engine**

**Kit Assembly Instructions**



**Manufacturer:**

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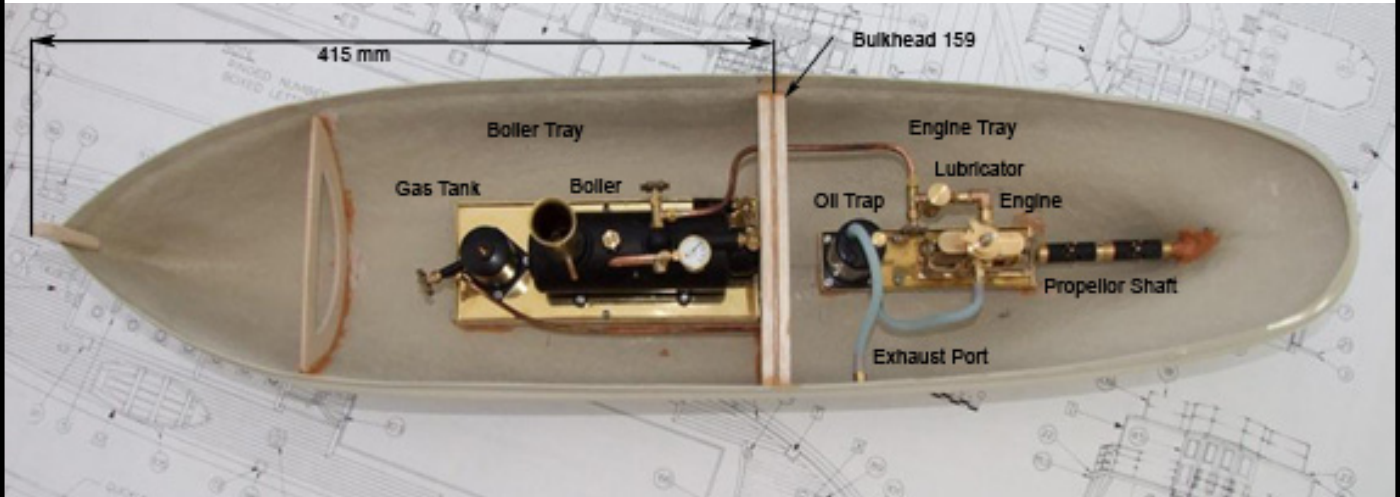
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## Caldercraft "Joffre" With "*Miniature Steam*" Custom Steam Plant

Whether fitting the plant to a new or established Joffre model it is important that the centerline of the bulkhead (159) is precisely 415mm from the tip of the stem. Access to run the plant through openings in the deck, to fit the propeller drive shaft and the pre-formed steam line depend on this dimension being exact. This datum is also important for positioning the boiler and engine wooden mounting blocks. Do not proceed until the bulkhead is correctly positioned.



The following items are required:

1. Refillable gas tank 1-1/4" P/N 4271
2. 2" Horizontal boiler P/N 4058 with 2" ceramic burner and gas pipe P/N 4016
3. Short gas tank refill adapter P/N 4358
4. Oil trap P/N 4063
5. "Avon" engine self assembly kit P/N 5027K or fully assembled P/N 5027
6. Mounting trays, steam pipe, pipe fittings, mounting screws as follows P/N 5035

Steam Engine Parts:

- Wooden base board & spacer P/N 2301
- Steam engine brass tray P/N 2844
- Inlet pipe fittings (M/F adaptor x 2, M/F 90 deg. bend x 1) P/N 2306
- Silicon Rubber tubing P/N 2307

Boiler Parts:

- Wooden base board & two spacer strips P/N 2302
- Boiler brass tray P/N 2845
- Special gas line (gas tank to boiler) P/N 2308
- Special flue 175mm P/N 2309
- Safety valve vent tube P/N 2310
- Special steam line (boiler to engine) P/N 2311

General Fittings

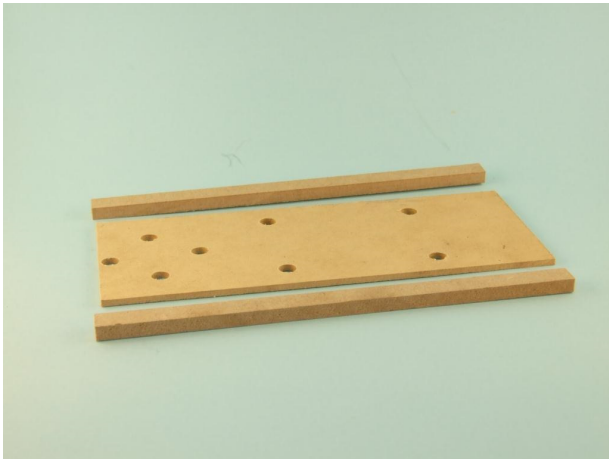
- Sundry stainless steel screws & nuts pkt. P/N 2305.
- Hull exhaust nipple P/N 5701
- Special twin universal joints assembly P/N 2313
- Propeller shaft & tube assembly P/N 5357
- 50 mm Miniature Steam/Caldercraft propeller P/N 1071M

Parts NOT supplied

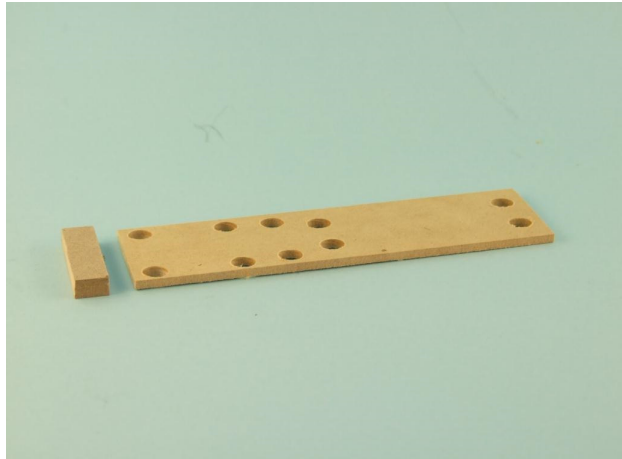
- Steam Oil
- RC Radio (2 channel min)
- RC Linkages

## Assembly Instructions:

### Step 1 Assemble the boiler & engine mounting blocks.

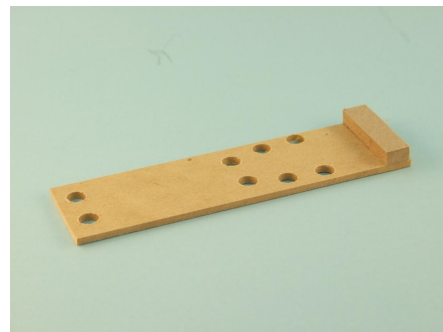
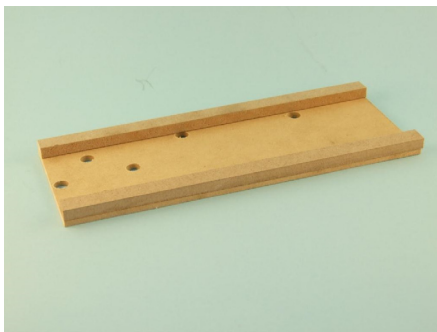


Boiler Tray Mounting Block parts as delivered



Engine Tray Mounting Block parts as delivered

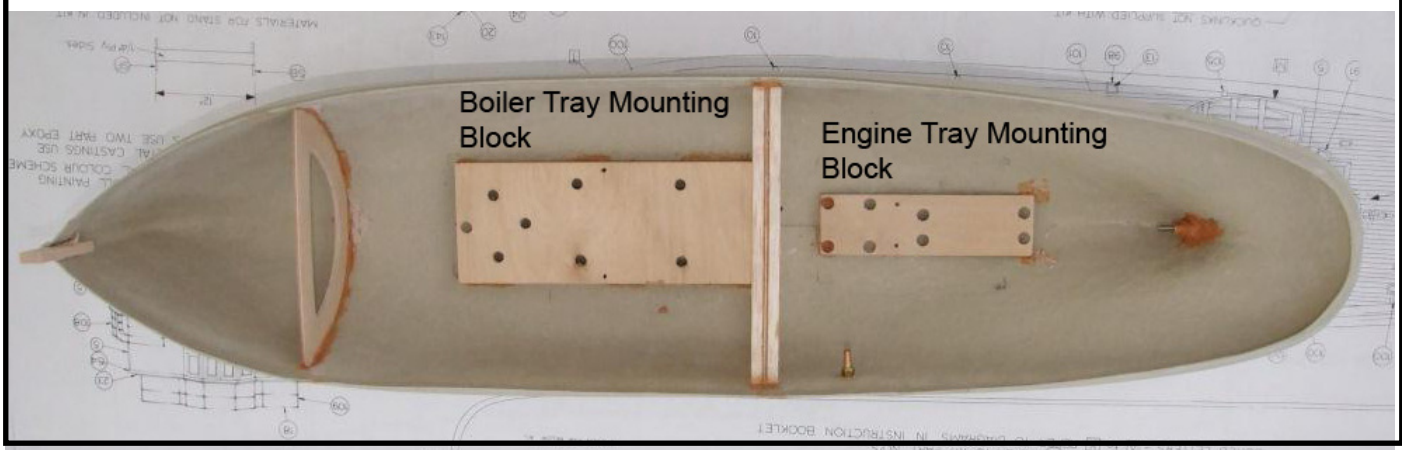
Glue the spacer blocks to the mounting tray blocks (the strips with holes in them) with 2-pack epoxy glue as illustrated in the following pictures. The spacer blocks are 10 mm x 6 mm. Apply the glue to the 10 mm surface.



When the glue has set, brush on a wood varnish to seal the wooden surfaces against oil and water that will be present in the hull space after a number of operating sessions.

### Step 2. Fit the tray mounting blocks into the hull

Position the Boiler Mounting Tray Block, oriented as shown below, and gently position it in the centre of the hull with the rear end of the block square against the bulkhead as shown. Using a 2 pack epoxy glue set the Boiler Mounting Tray Block ONLY at this time and put aside to allow the glue to set. Place a mark on the hull 38 mm from the rear surface of bulkhead to mark the position of the Engine Mounting Tray Block as illustrated. The Engine Tray Mounting Block should be glued after correctly aligning the engine with the propeller drive shaft as described in .Step 9.





### Step 3 Sort & Identify the screws to be used in mounting the components

Lay out the screws and nuts supplied. There should be 4 wood screws for securing the two trays to the mounting blocks, 8 mm x 8 stainless steel screws and nuts for securing the boiler and engine to the boiler and engine trays. 6 mm x 4 stainless steel screws and nuts for securing the oil trap to the engine tray, 12 mm x 4 stainless steel screws and nuts to establish a fixing jig for the gas tank. Extra items are included to cover for accidental loss.

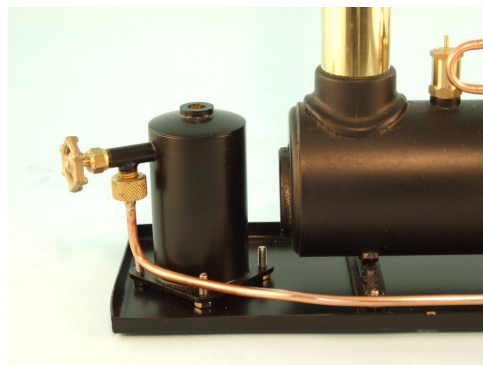
### Step 4. Mount the boiler tray components on the Boiler Mounting Tray



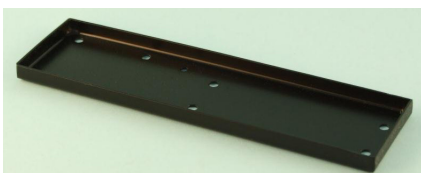
The screws for attaching the boiler and gas tank are normally inserted from the underside of the mounting tray but optionally from the upper side. The boiler is mounted with the burner port facing away from the gas tank. Use the 8 mm screws provided to secure the boiler.

The gas tank screws are 12mm long, are inserted from the underside of the tray and are secured with nuts BEFORE the gas tank is fitted. This is illustrated below before and after the gas tank is fitted. This allows the gas tank to be easily removed for refilling while maintaining a firm seat for the tank during use. It is very important to remember to remove the gas tank from the boat into open air for refilling.

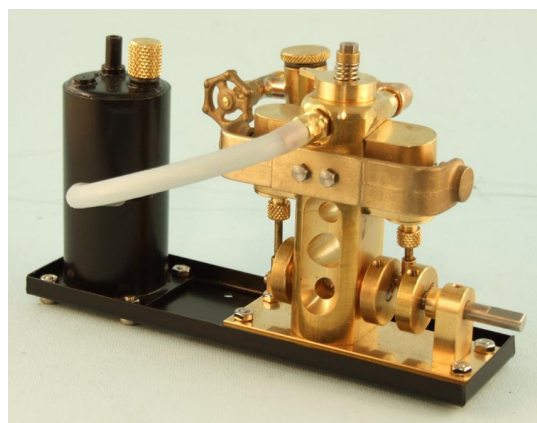
**DO NOT BE TEMPTED TO REFILL THE TANK WHILE IT IS IN POSITION IN THE BOAT: YOU RUN A SERIOUS RISK OF TRIGGERING A GAS EXPLOSION WHEN RESTARTING THE BOILER.**



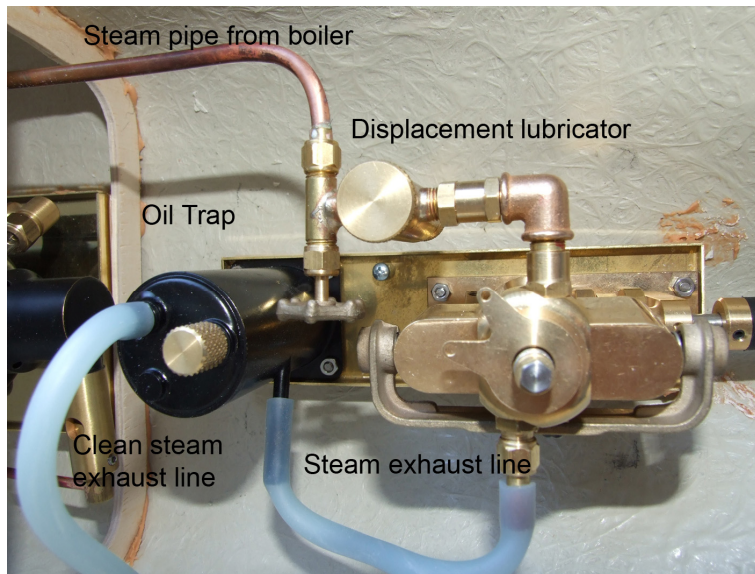
### Step 5. Mount the components on the Engine Mounting Tray:



Assemble the engine as set out in separate instructions supplied in the engine box. Make sure it is spinning freely before, and after, screwing it to the tray with the 8mm screws aligned as illustrated. If there is any uneven tightening the engine may stiffen and not run properly. Screw the oil trap to the tray with the 6mm screws supplied.



The picture below is a close up plan view of the engine illustrating the plumbing required to deliver the steam to the engine and the piping involved in exhausting it. The exhaust steam is delivered through silicon rubber tubes pressed on to the appropriate fittings. The cleaned steam exhaust line is connected to the brass nipple fitted to the hull and exhausted to atmosphere.



### Step 6: 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 7: Commissioning:

**This is best done before finalising the fitting of the assembly into the boat hull.**

Place the boiler and engine trays on a flat particle board surface or similar and connect the steam line to both units as illustrated. Using the wood screws supplied, screw the two trays to the board surface. Steam oil and a master gas supply tank and the syringe for removing oil from the oil separator and filling the boiler will be required for ongoing maintenance of the steam supply.

Calibrate the Ceramic Burner as per the instruction sheet supplied with the burner.

#### Running the Boiler

- Remove the safety valve and, using the boiler refill 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 safety valve and lightly tighten with a spanner
- Check that the steam stop cock on the boiler is closed.



- **If the boiler is cold**, remove the burner from the boiler, turn on the gas valve a little, light the burner directly, reinsert the burner into the boiler and open the gas tank valve fully.
- **If the boiler is warm**, open the gas valve a little and hold a gas gun (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. (A suitable gas lighter can be purchased at most Supermarkets)
- 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 boiler is mounted close to the gas tank and it will soon warm it 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

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 fully open the steam cock on the boiler and adjust the steam cock on the lubricator to allow some steam to flow through to the engine and heat the steam pipe and the engine cylinders. When these are cold some condensation will blow out when the steam reaches the cylinders. This is normal.

- Adjust the lubricator steam cock to produce the power required for the engine. This setting can be retained for future running since the boiler steam cock is used as a Start/Stop valve. If the safety valve blows off after the engine reaches the desired operating speed adjust the gas valve to reduce the gas supply as well.

#### **Filling the gas tank:**

Disconnect the gas pipe from the gas tank and remove the tank from the mounting tray before filling as instructed in the Test Certificate. When refilling the gas tank it is normal for the tank to cool down. This may aggravate the condition noted above when starting the boiler. In very cold conditions it may be necessary to warm the filled tank to room temperature preliminary to re-fitting it into the tray.

#### **Test certificates for each pressure vessel:**

Formal Test Certificates, general safety recommendations and filling instructions for the boiler and gas tank are enclosed in each pressure vessel box. These should be read carefully and stored in a safe place for future reference.

#### **Recommended Propellers & Drive Shafts:**

To obtain maximum performance from your plant we strongly recommend you avoid using fabricated propellers. Precision cast Caldercraft/”**Miniature Steam**” propellers and matching propeller shafts will deliver top performance from your steam plant.

## Step 8 Assembling 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.



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/tube assembly into the hull and slide the thrust collar onto the propeller shaft. Secure the thrust collar to the propeller shaft when there is no longitudinal slack between the thrust bearings. Inside the hull, lightly secure the propeller shaft by the grub screw in the end of the universal joint that has the smaller bore. (the propeller shaft is 4 mm diameter while the engine drive shaft is 5 mm dia) The propeller tube will later be secured in position in the hull with motor body epoxy filler or equivalent after correct alignment of the drive train with the engine and its mounting.

## Step 9 Installing the plant in the boat hull

- Locate the fully assembled boiler tray on the boiler tray block with the tray forward edge pushed firmly against the bulkhead and secure it to the block with two of the woodscrews supplied
- Slide the engine drive shaft into the forward universal joint in the drive train ( the one with the larger bore) and 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. When this is achieved mark the position of the engine tray block assembly on the hull for its future gluing to the hull. Slight slackening of the universal grub screws may be required to allow the removal of the engine tray assembly.
- Apply two pack epoxy glue to the underside contact surfaces for the engine tray block and fit the block assembly to the marks made in a previous step. Wait for the glue to set before proceeding.
- When the glue is set, re-assemble the drive train and check that it still rotates smoothly.
- Fill the boat hull/drive shaft cavity with motor body epoxy filler and as it sets check for smooth rotation of the drive train assembly. Make small adjustments as necessary before the filler sets.
- Connect the steam line to the engine and the silicon tubes to the exhaust system.
- Fit out your RC linkages and you are ready for steaming trials.