MECHANICAL BRANCH MODELS

GENERAL INSTRUCTIONS

FOR

Assembly and Finishing

5,000 GALLON CAST IRON WATER TANK AND STEEL STAND KIT

FROM 1st JULY, 2019
(And Until Further Notice)

REVISION 1.1

Mechanical Branch Models take pride in the accuracy of their products. However, sometimes compromises have to be made to enable assembly. Parts are as thin as possible which means they are easily distorted and damaged. Always exercise care when handling and assembling parts.

It is recommended that soldering be used for assembly, unless otherwise noted. Drill holes prior to removing parts from the fret.

Remove etched parts from the fret only as they are required so that they can first be identified.

Clyde

Koorawatha

Riverstone

Detail, Orange (40,000 gal tank)

1. Prototype information

Water tanks were an essential component of any railway in the steam days. At their peak there were over 400 watering locations which employed tanks of different capacities and heights depending on operational considerations.

While the NSWGR eventually settled on standard components and construction methods, few tanks were identical. However, there were definitely similarities and tanks using the standard 4'-2" x 4' -2" cast-iron panel and rounded corners panels became very common from around 1910.

The tankstands also employed common parts and construction methods but also varied based on the tank size and height.

5,000 Gallon Tank and Tank Stand

The single-tier tanks of 5,000 gallon capacity was a standard design, examples of which were at Narrabri West, Nyngan, Port Waratah, Bankstown, Clyde, Broadmeadow, Culcairn, Koorawatha and Dunheved.

10,000 Gallon Two-Tier Tank and Tank Stand

The two-tier tank of 10,000 gallon capacity was based on standard components with one example at Wellington. Other examples at Riverstone and Richmond, had taller tankstands.

Note that both types of tank existed on stands of different heights and multiple panels than the one supplied in the kit. If you're modelling a particular location, it's best to check prototype photographs.

2. General guidelines

Solder assembly is recommended. Excellent results can be obtained with a 140 degree tin/lead solder and a solution of 10% Phosphoric acid as a flux.

Clean as you go and remove all flux residue by washing in CLR or soapy water to prevent corrosion.

A fibreglass brush is recommended for polishing.

Side or end-cutters are recommended for removing parts from the fret.

File any residual material off until the edge is flush and smooth.

3. List of parts

Tankstand

Description	Part number	Quantity
Tankstand panel soldering jig	1056	2
H Column - 8" x 6" 45mm long	1058	6
H Beam 6" x 5" 43.8mm long	1059	4
Tension ring	incl w/ assy jig	4
Tension member	0.3 dia wire	16
Assembly jig - 8" x 6"	BSB14	2
Assembly jig - 6" x 5"	BSB10	2
Footing, 2'-6"	-	4

Tank

Description	Part number	Quantity
Tank side	1054 (5000 Gal)/1057 (10000 Gal)	4
Tank bottom, inner	1049	1
Tank bottom, outer	1049	1
Tank corner casting (vertical)	1045 (2 tier) 1046 (1 tier)	4
Tank corner casting (horizontal)	10	4
Internal bracing	1001	8
Tank top flange	-	1

Finishing

Description	Part number	Quantity
Equilibrium valve float	1042	1
Equilibrium valve	1043/1044 2 tier/1 tier	1
Level gauge float	1011	1
Jib bracket	1041	1
Jib U pipe	1062	1
Jib outlet pipe	-	1
Jib	1061	1
Right angle crank	-	2
Tank maker's plate - 1929	-	1
24'-4" Ladder	1010	1

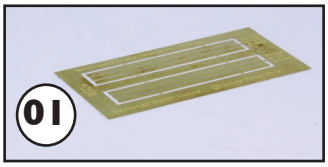
Etched parts generally show the part number on the fret of the etch.

4. Assembly

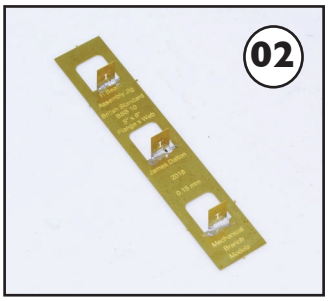
Part A: Tankstand

A1. Assembly of steel sections

A1.1 For scale accuracy, structural sections are soldered together using the jigs provided. Each 'I' beam joist is comprised of two flanges separated at a distance by a "web". They are assembed using the jigs provided (Figure 1).

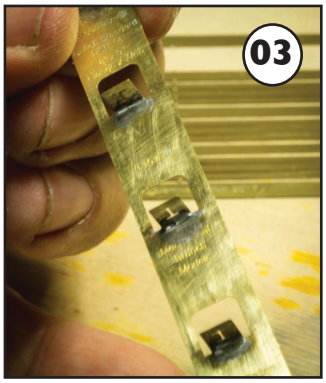


There is a small difference in size between the web and flanges of the joists and they must not be confused or they will not fit in the jig (Figure 2).



Fold the jig verticals up as shown in the figure and reinforce the bend with solder. (Figure 3)

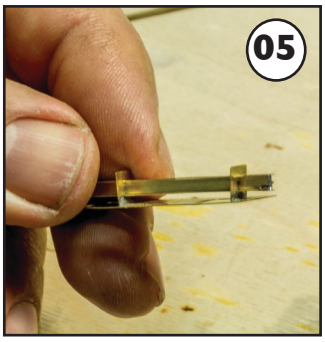
A1.2 Remove the flanges and web from the etch and remove the tabs. This is best acheived without bending the brass by placing the strip in a piece of 9mm ply which has had a groove cut in it with a razor saw, and filing across the edge of the strip to completely remove the tab. (Figure 4)



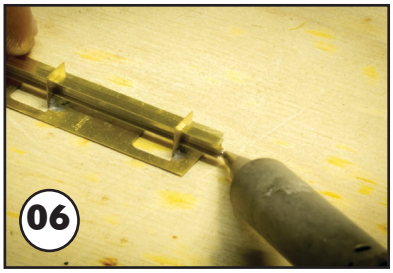
A1.3 Feed the bottom flange into the jig, through the vertical guides. Tweezers are useful for this. Feed the web through the vertical guides, followed by the top flange. If the top flange does not fit, the web may be too wide and require more filing (Figure 5).

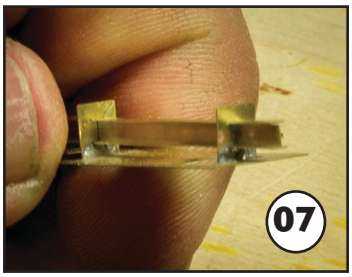
A1.4 Align the ends of the flanges and web. The end should be protruding clear of the jig vertical by about 10mm. It is important not to contaminate the jig with flux or solder as it can make subsequent use impossible. (figure 5)

A1.5 Support the end of the beam with a piece of scrap balsawood. Apply flux to the joint and apply solder to the end of the beam. Hold the iron against the end of the beam - you should see solder flow along the joint towards the jig. Feed out some more of the beam and continue to solder. Frequently check that the a good joint has formed top and bottom. (figure 6)



A1.6 Remove excessive solder with solder wick. Be careful to do this as you go, in the jig. Applying heat when the beam is not held by the jig risks distortion and collapse of the whole assembly (speaking from experience here). (Figure 6).





A1.7 When the beam has been soldered from end to end, remove flux and wash in in CLR solution.

In total there are:

- 4 columns/2 beams of 6" x 8" RSJ x 25'6" (45 mm) long
- 4 beams of 6" x 5" RSJ x 25'6" (43.8 mm) long

It is suggested that you assemble all of these prior to moving on to Section A2.

A2. Assembly of box section

This tank is supported by one "box", a self supporting braced structure supporting the tank. You will need to assemble the "box" using the 6" x 8" joists made in section A1 and the etched jigs provided.

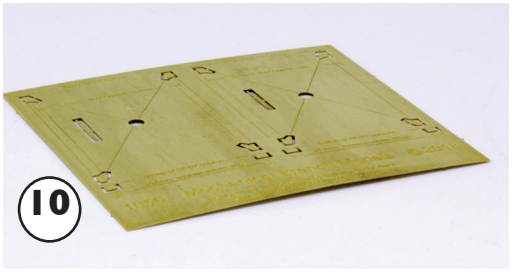
The jigs are designed to construct the two cross-member assemblies and to join them to the columns so that they are square and parallel.

A2.1 Assembly of cross-members

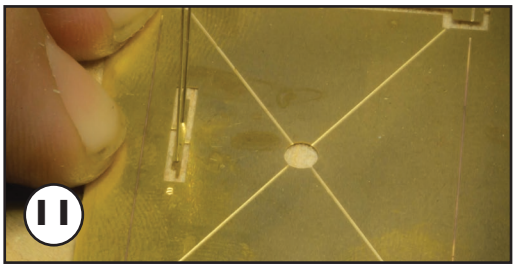
(Figure 9) The tension rings are a distinctive characteristic of this model and it is suggested that time and care be taken in their assembly. Jigs are provided to assist (Figure 10)

The rings are formed from straps, each with four holes for the tension rods (cross-members). If the straps are formed into a ring they have a tendency to fold at the location of the holes and a square shape will result every time. To avoid this, the following method is recommended.

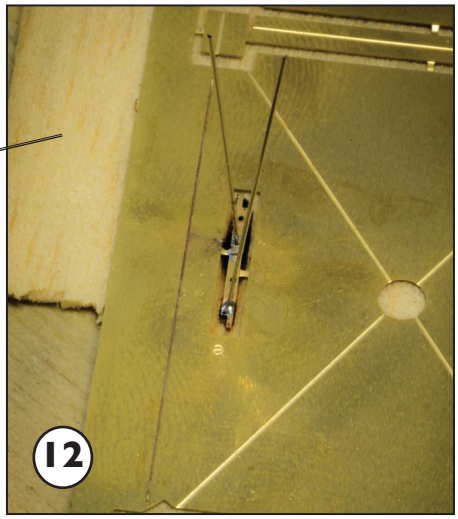
A2.1.1. Using the jig (Figure 10), measure and cut eight lengths of 0.3mm nickel silver wire, each approx 23.5 mm long.



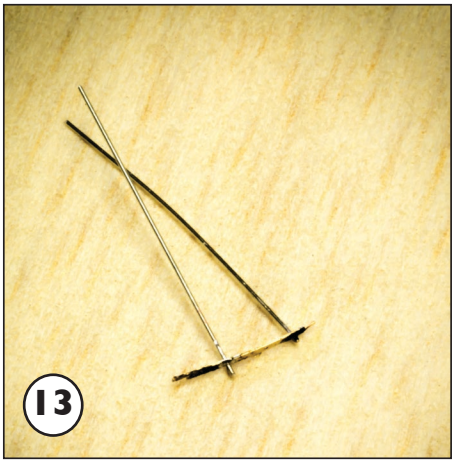
A2.3.2 Place the jig on a piece of 1mm balsawood. Insert the 1" dia wire (0.3mm) into holes 1 and 3 or 2 and 4 (Figure 11). Solder in position (Figure 12).



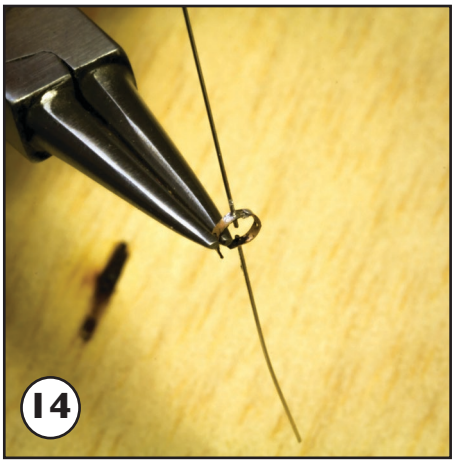
balsa sheet

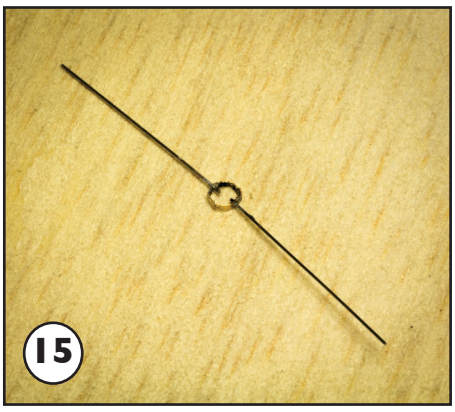


A2.3.3 Cut the strap out of the jig. Trim the wires so that 2" (0.6mm) protrudes past the inner surface of the strap. (Figure 13).



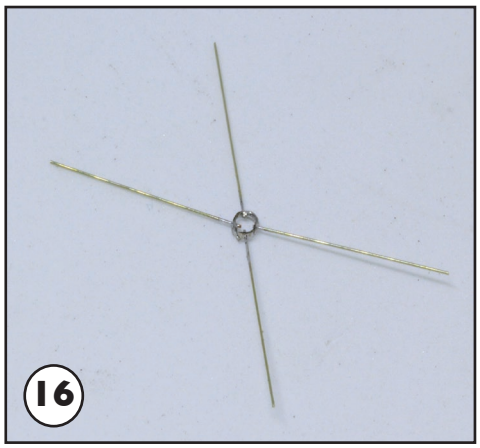
A2.3.4 Now the wire can be used to form the strap into a ring shape. Fine needle-nosed pliers are also indispensable in forming a smooth ring. (figure 14, 15)



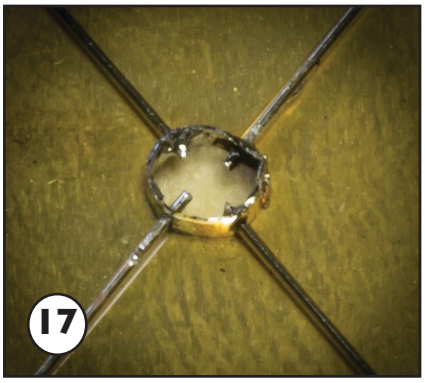


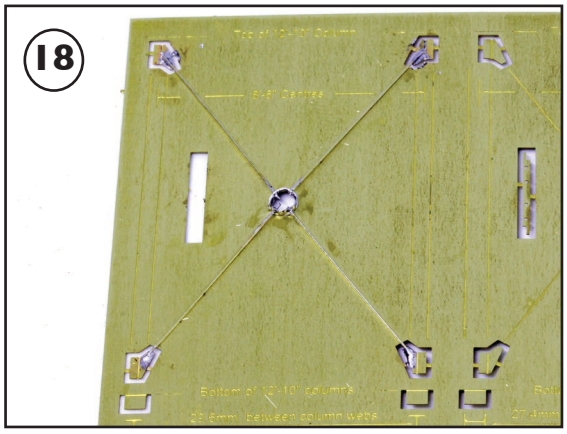
A2.3.5 Lay the ring into the centre of the jig. Insert the two remaining tension rods into the ring and carefully solder in place. Notice that the holes are not equally spaced. Ensure the holes are aligned with the tension rod positions marked on the jig. The assembly should appear as in Figure 16.

You should now have a ring with four rods radiating outwards, and symmetrical on the horizontal and vertical axes. (Figure 16)



A2.3.6 Check that the ring is still an even circle and solder where the two ends of the strap join to form the ring. (figure 17)

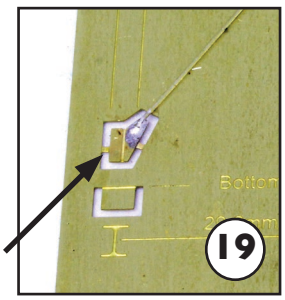


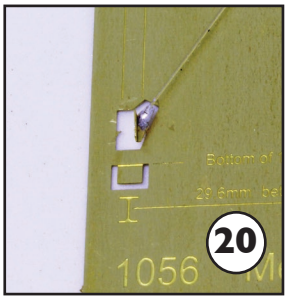


A2.3.7 Each wire can be soldered to the brackets in each corner of the panel. Minimise the amount of solder used. (figure 18). Try not to let the solder run into the fold line, which will make it more difficult to fold the bracket.

A2.3.8 Carefully cut the tab shown in Figure 19. Gently fold the tabs along the fold lines as shown in Figure 20. These represent the angle brackets that join the cross members to the columns.

cut here (4 places)



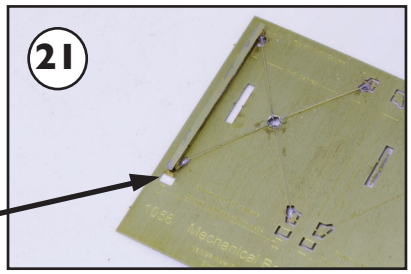


A2.3.9 Fold up the locating tabs as shown in Fibure 21. These ensure the columns are in the right relationship with the cross-bracing.

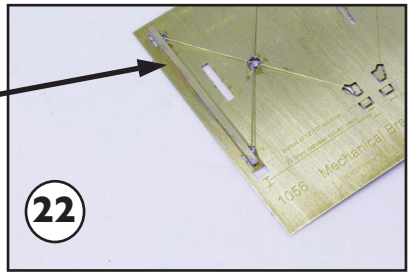
Place the column on the jig ensuring that it is aligned with the etched guidelines on the jig and agains the locating tab. Note that the orientation of the joist is etched into the jig. Ensure the column is oriented correctly.

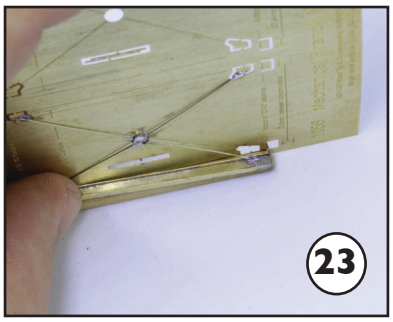
Check that the brackets are resting against the web of the column.

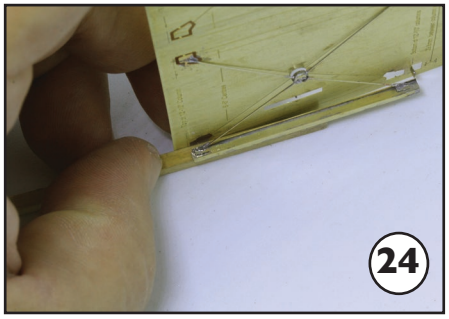
locating tab

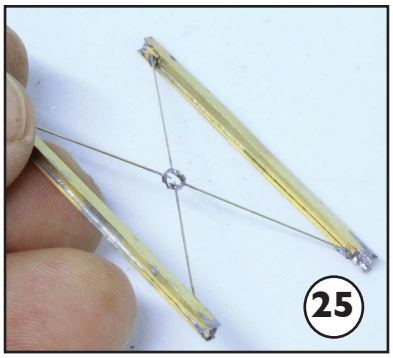


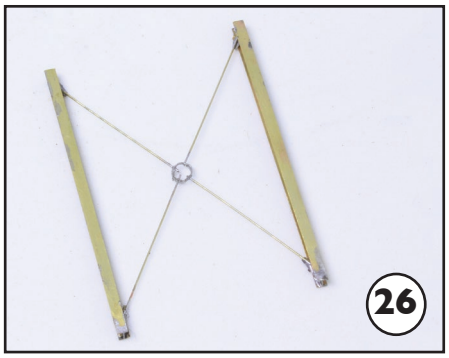
guidelines











A2.3.10 Carefully solder the brackets to the flange of the columns. This requires careful management of heat to prevent the bracket being unsoldered from the tension rod. Use plenty of flux and a short application of the soldering iron. (Figure 23). Repeat with the second bracket.

Repeat with the second column. (Figure 24)

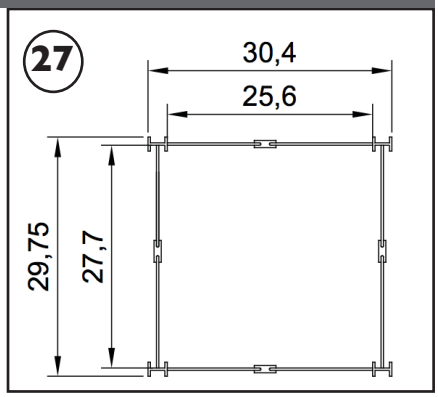
A2.3.11 You should now have a completed panel which looks like figure 25 & 26.

A2.4 Panel Assembly

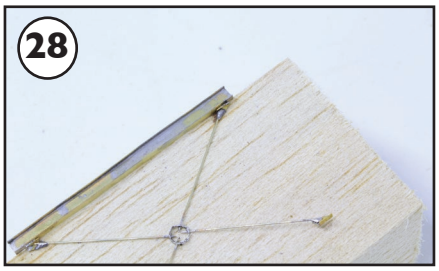
A2.4.1 See figure 27. Although the box is 8'-0" (28mm) square, connecting between flanges and webs requires two different jigs.

This is because the distance between flanges is 6'-6" (19.7 mm) and the distance between webs is 7'-6" (22.45mm).

IMPORTANT: Make sure you are using the correct jig when joining the cross-member assemblies to the joists.

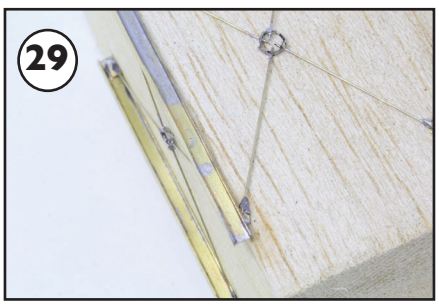


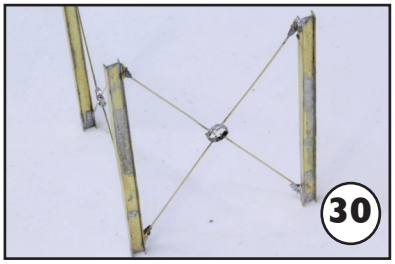
A2.4.2 Using a suitable former (a block of balsa is recommended), carefully solder the second panel to the flange of the column as shown in Figure 28 and 29. Make sure the brackets are aligned with the brackets in the first panel.

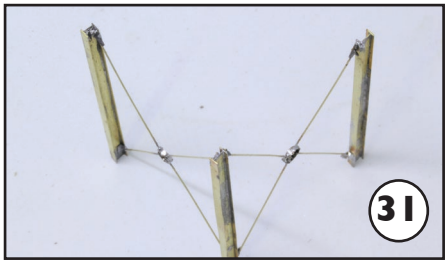


A2.4.3 Now the two opposite panels can be joined together to form the box. Ensure the brackets are soldered in the correct positions and that the box is square in cross-section and to the ground. The result should appear as in Figures 30 and 31.

Wash carefully to remove flux.



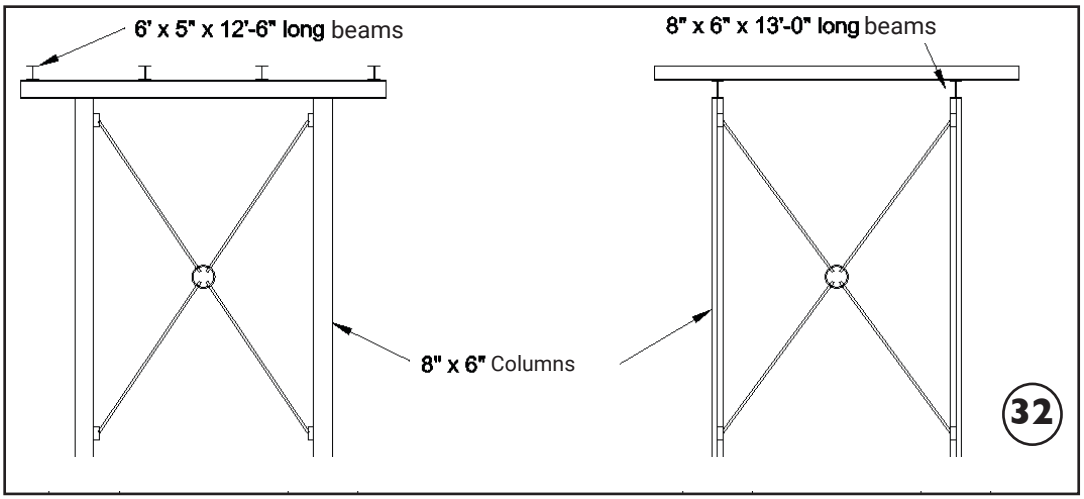




A3. Tankstand Assembly

A3.1 Figure 32 shows the correct placement and orientation of beams and columns. At this stage, just solder the 8"x6" beams to the tops of the columns. They are symmetrically placed. Notice that the beams are oriented so that the web is vertical ("I" orientation).

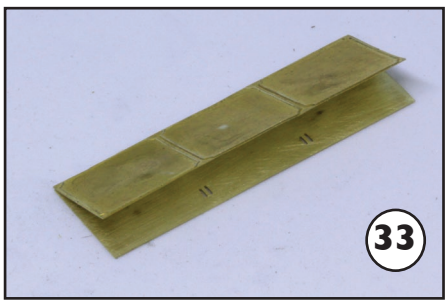
The 6" x 5" beams are shown here on top of the 8" x 6" beams but they are fitted later, in step B2.2.

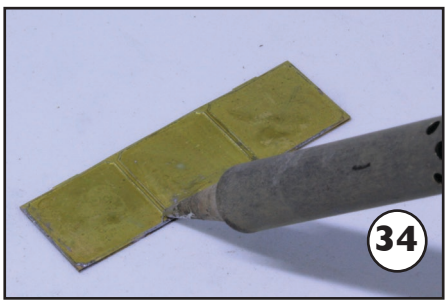


Part B: Tank

B1. Tank sides

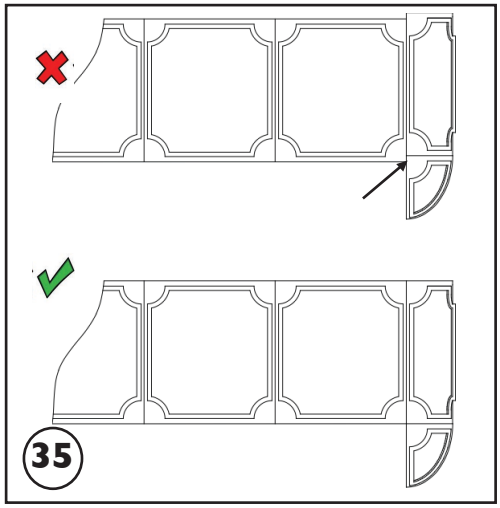
B1.1 Fold the four tank sides along the fold-line shown. Tin the inner edge and join the inner and outer sides together. (figures 33 and 34)





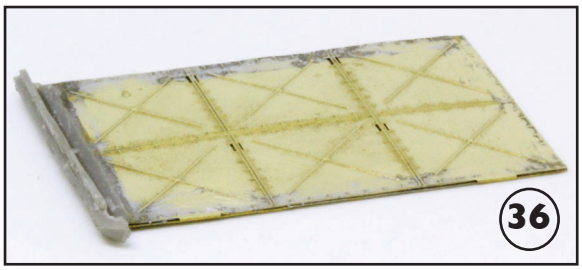
B1.2 Identify the tank corners. Superglue a corner to a side ensuring the top of the corner piece is level with the top of the side. (figure 35 & 36).

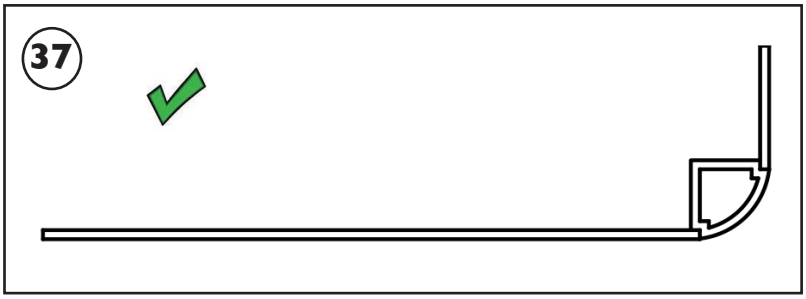
IMPORTANT:
Ensure the tank sides are oriented correctly - the small slots for the struts are nearer the top of their respective panels.

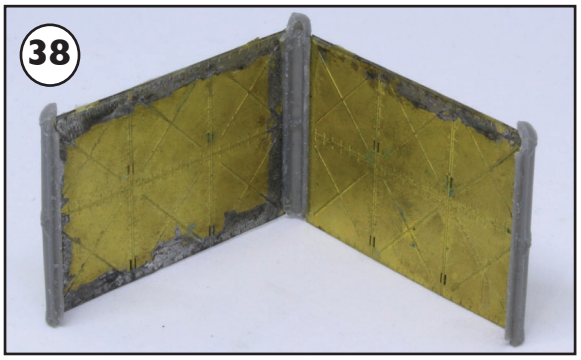


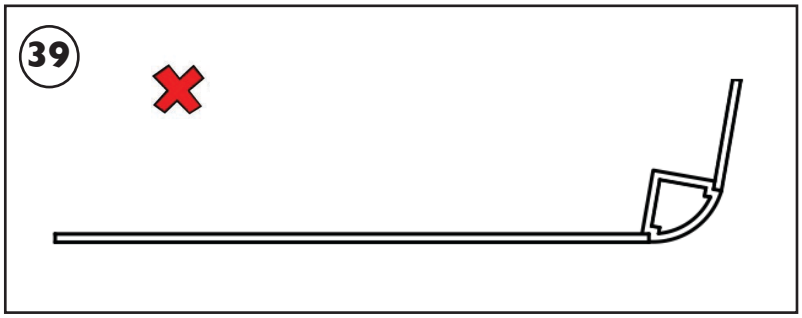
B1.3 Glue the second corner to the other end of the same side. Ensure corners are square.

B1.4 Repeat B1.3 on a second side.



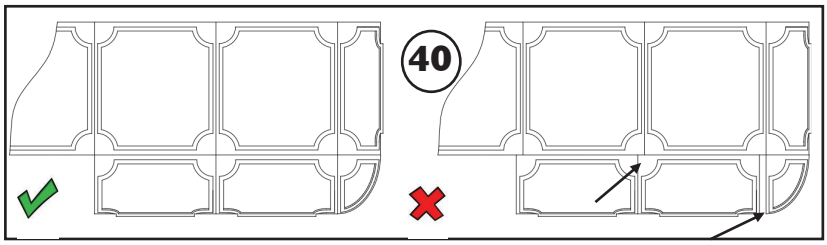




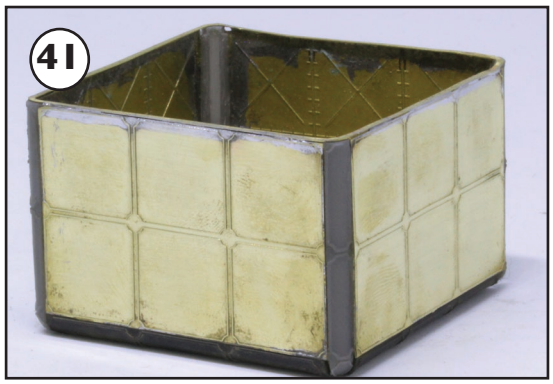


B1.5 Superglue the curved bottom edges to the inside long edge of the side between corners. Check that the panels line up and minimise the gap between the corner piece and the bottom piece.(Figure 37) Set aside for glue to dry.

B1.6 Glue a third side between two ends of sides 1 and 2. Glue in the fourth side. Ensure the assembly is square. Set aside to dry.

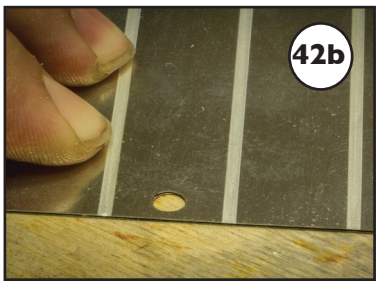


B1.7 When fitting the bottom corners ensure the panels on the 3-d printed parts align with the panels on the etched sides. This is shown by the arrows in Figure 40.

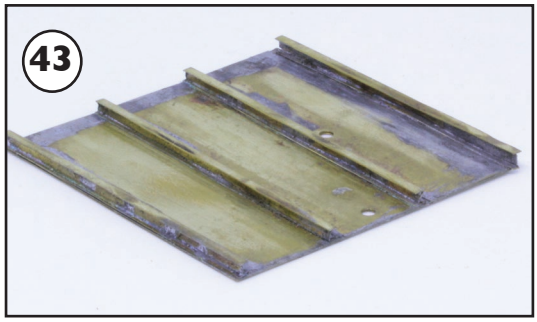


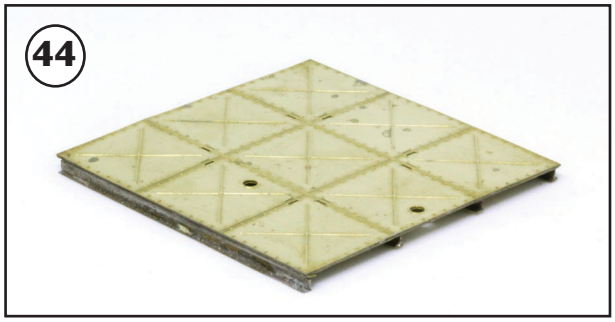
B2. Tank bottom

B2.1 Solder the inside of the tank bottom to the outside tank bottom. Figure 42a shows the tinning of the inside edges; 42b the aligning of the t inner and outer etches; and 42c the sweating of the two together.

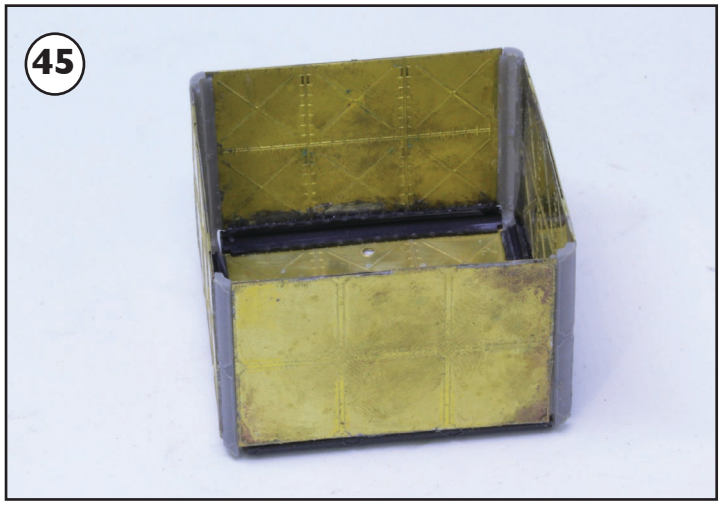


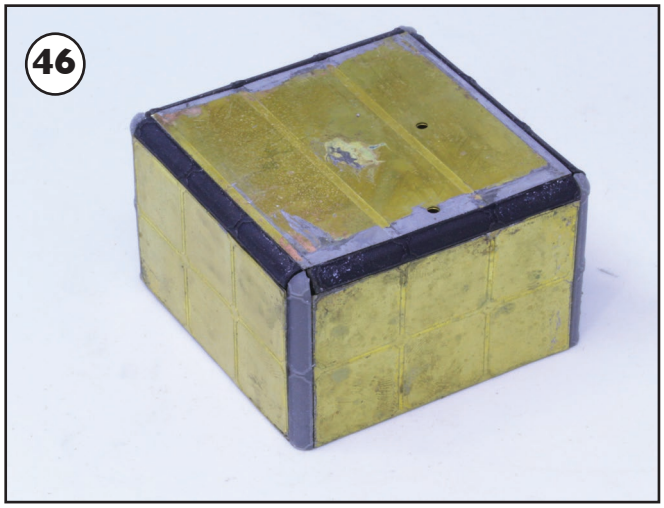
B2.2 Solder the four 6”x5” bearers to the tank bottom in the half-etched tracks. Be careful not to apply too much heat to avoid damaging the bearers. A safer alternative can be to use adhesive or a lower-melt solder. (Figure 43)





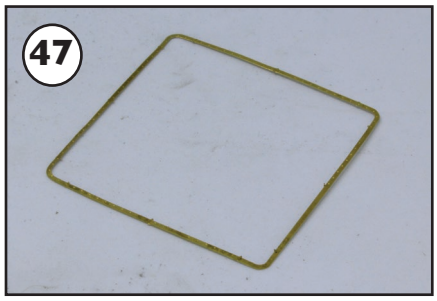
B2.3 Invert the square tank assembly. Place the bottom of the tank into the assembly. With minimal fitting, it should fit neatly between the bottom corner pieces all the way around. Superglue in place.





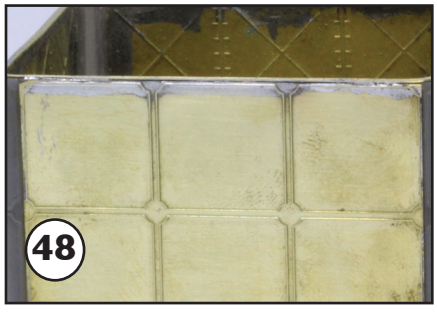
B3. Tank final assembly

B3.1 Carefully remove the top edge of the tank - this is an etch which represents the edge of the cast-iron tank sides. Check for fit and adjust the sides if necessary. The outside edge of the part should be flush with the outside of the tank. Don't worry too much about filing the tabs flush - it's difficult to do without damaging the fragile frame. This is easier when it's soldered to the tank.



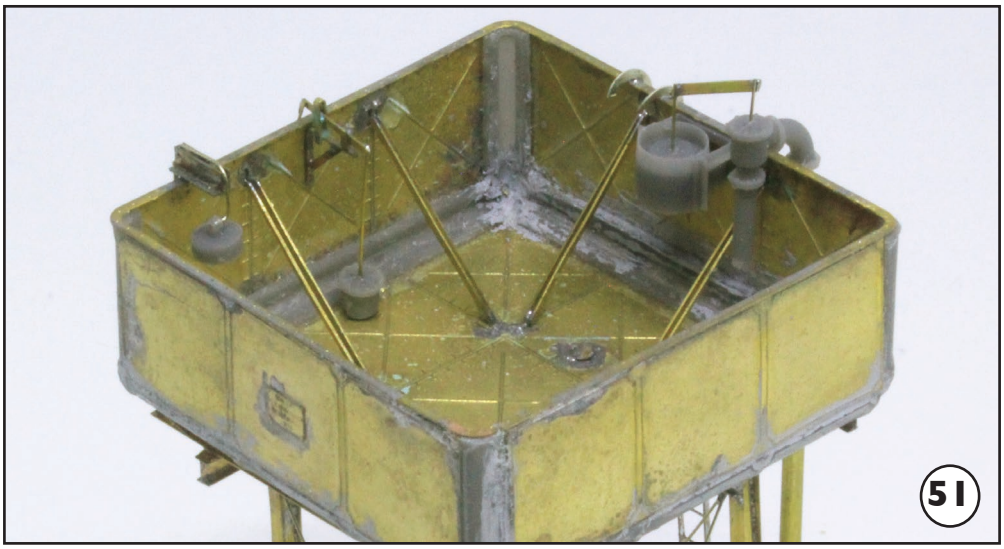
B3.2 Tack-solder to the top of the tank. When satisfied with the position, carefully solder the edge to the sides around the tank, filling gaps with solder. Figure 48.

B 3.3 Larger gaps can be filled with putty. File and sand so that the join is invisible. Figure 46 (note 6" x 5" beams are not shown in this figure).



B3.4 Solder the maker's plate to the side of the tank. It was usually in the centre of one of the centre panels (figure 49). Check photos of the prototype if you are modelling a specific tank. Plates with different years of manufacture are provided (Figure 50); other years are available if required.

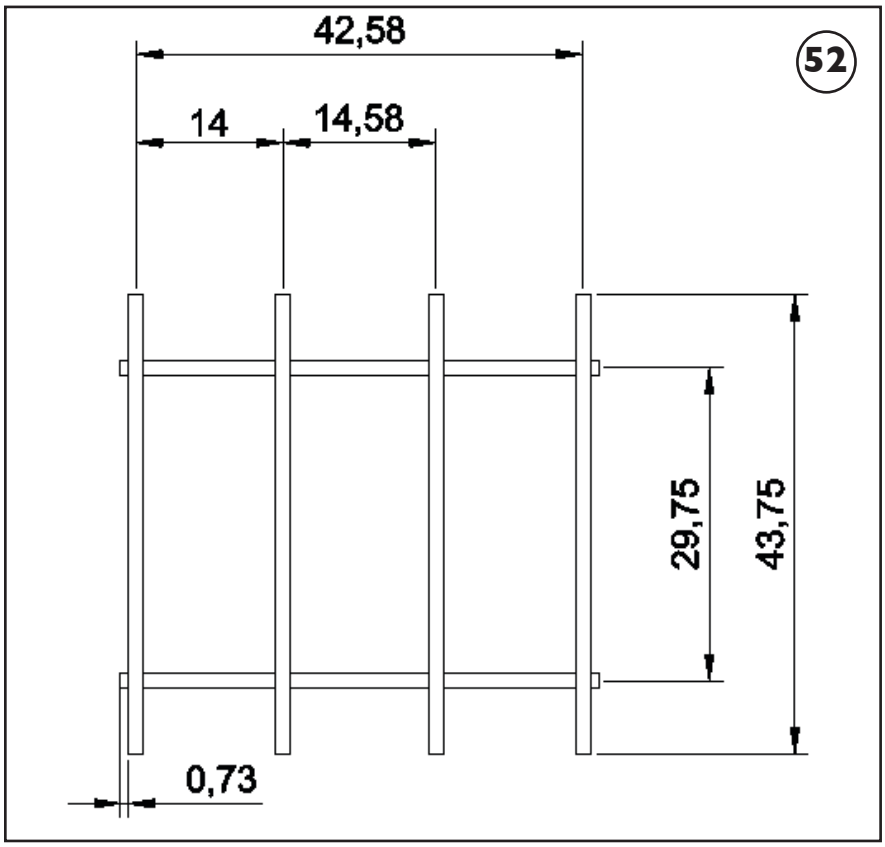
B3.5 Form the 8 internal braces and solder in place between the bottom and side of the tank. There are slots to indicate the postions (see Figure 51).



Part C: Final Assembly and Finishing

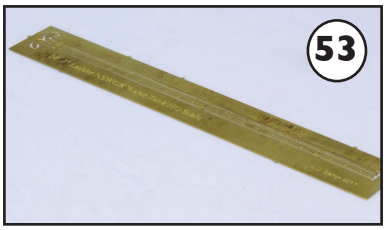
C1 Assemble tank to tankstand

C1.1 Place the tank on the stand ensuring that the relationship of the 6”x5” tank bearers and the 8”x6” beams as per Figure 52. When square, solder the bearers to the beams where indicated (it’s not necessary to solder at all points where the bearers intersect the beams - just enough to hold the stand in the correct relationship with the tank).

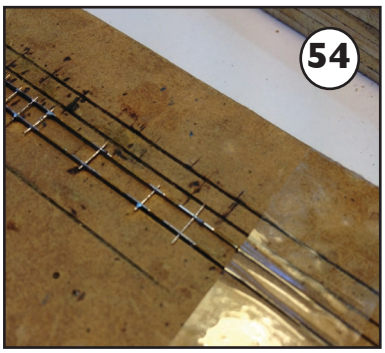


C2 Assemble ladder

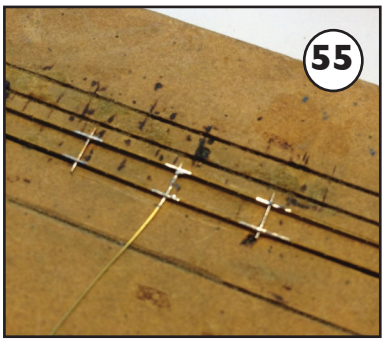
C2.1 Fabricate the ladder. It is recommended to use a small length of 12mm MDF with shallow parallel grooves cut into it with a razor saw. These grooves are 13.5" (4.4mm) apart which is the separation between the ladder stiles (note that this is wider than a standard signal ladder). Ladder etch is shown in Figure 53.

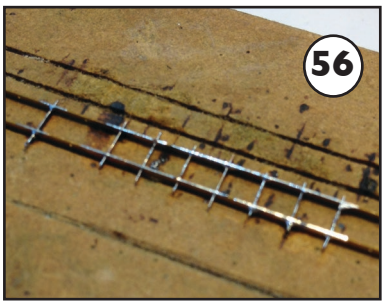


C2.2 Tape down the ends of the ladder stiles and pass some 0.18mm brass wire through opposing holes, at the top and bottom ends of the ladder and one or two at the middle. Figure 54 and 55. Check that the rungs are square to the stiles before adding the remaining rungs. Figure 56. Overheating the brass will cause distortion.



C2.3 Ensure that the solder joints are sound before trimming the excess wire either side of the stiles. Solder wick is useful for removing excess solder. Carefully file the stiles to remove excess wire and solder.





C3 Install ladder

C3.1 It is recommended to make a base for the tank from sheet styrene or ply. Attach the concrete footings to the tankstand columns. The flanges of the footings attach to the flanges of the column RSJs.

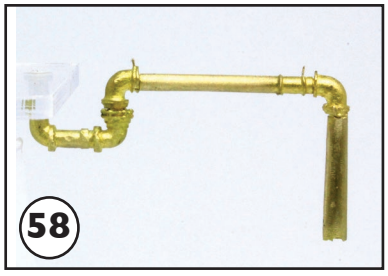
C3.2 The ladder reaches from the top of the tank to the ground.

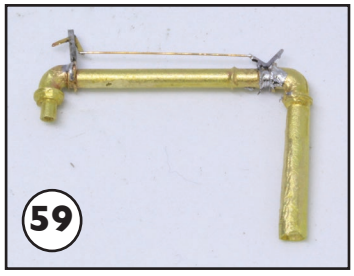
The ladder is arranged as shown in Figure 57 and glued in place.

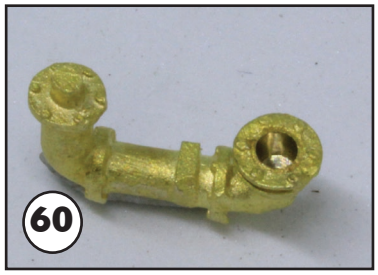
C4 Assembly of Jib

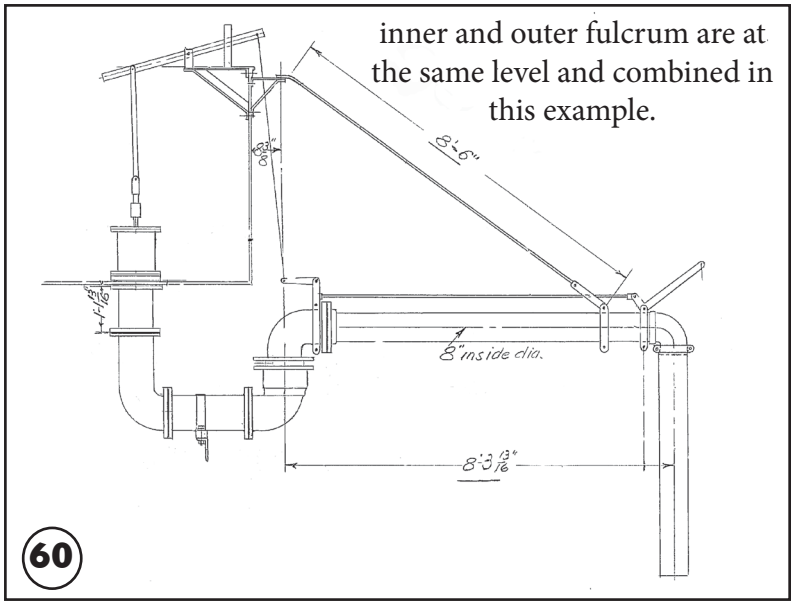
The jib is comprised of two brass castings, the U-pipe and the boom, and two bellcranks. The cranks form part of the mechanism which opens the valve so that water flow can be controlled by the crew when standing on the engine tender. The detail of the mechanism is an optional detail because it can be fiddly.

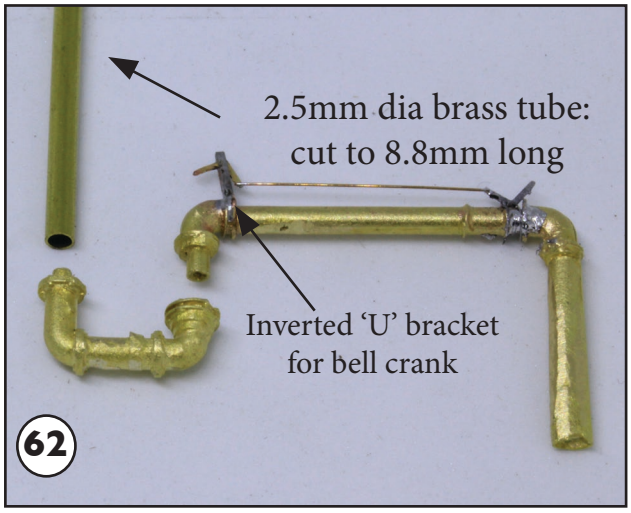
The U-pipe can be drilled out to 2mm x 2.7mm deep, to better accommodate the spigot on the end of the boom (Figure 60). The jib can be assembled in the extended or stowed position.







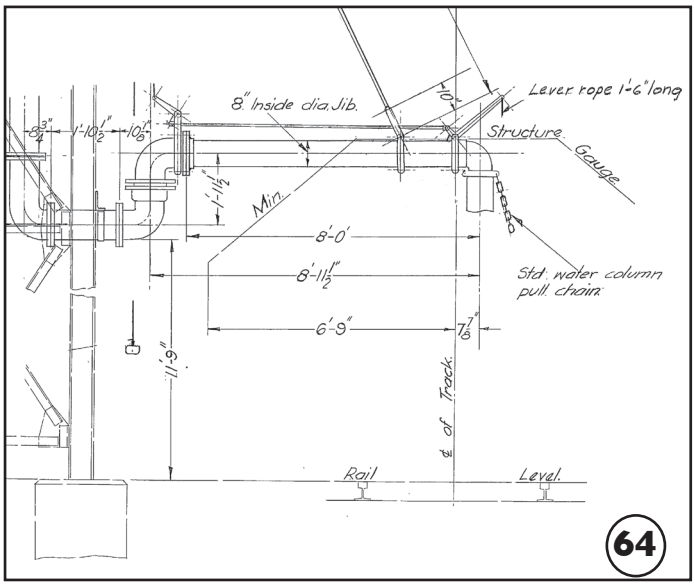




Figures 60 and 63 show the arrangement of the jib on a single tier tank (such as the 5,000 gallon tank).

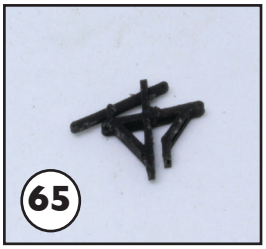
The bracket for the inner crank is a tight "U" fabricated from 0.8 x 0.1mm brass strip.

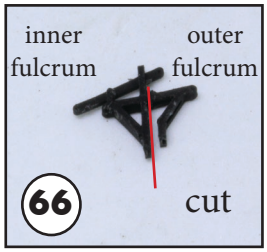
C1.2 Figure 62 shows the assembly of the jib. The 2.5mm brass tube needs to be cut to length to position the jib at the right height. For the tankstand in this kit, cut the tube 2'-6" long (or 8.8mm). The relationship to the structure gauge is shown in Figure 64.
Figure 61 shows the typical attachment of water outlet pipe to the underside of the tank.

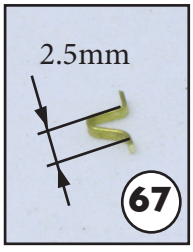


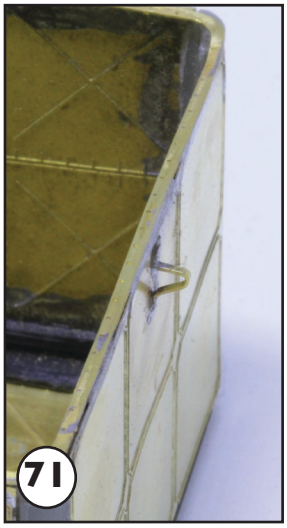
Photos and drawings indicated that the position of the fulcrum bracket was not consistent. If modelling a particular tank, check photos for placement. The determining dimension is the height of the jib boom. This is also not consistent but there is a theoretical minimum between the jib and the fulcrum.

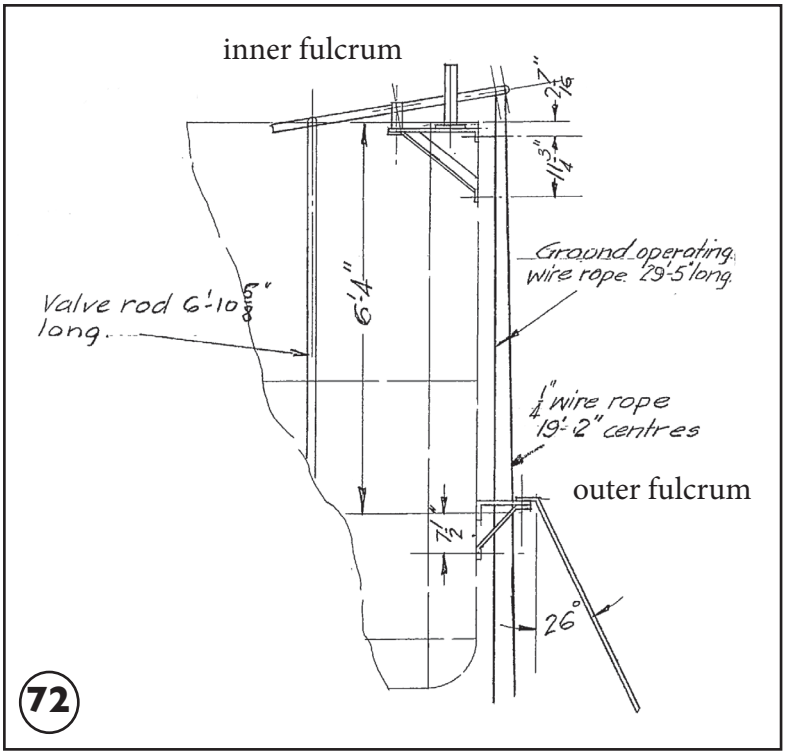
C4.2 For the 5,000 gal tank, the inner and outer valve fulcrum is one 3d-printed part, as shown in Figures 60 and 65. However, Figure 63 shows a fabricated fulcrum on a single tier tank lower than that shown in Fig 60. For the 10,000 gal tank, the outside fulcrum is usually lower on the tank. Cut off the outside fulcrum as shown in Figure 66. Fabricate a replacement fulcrum from 0.8 x 0.2mm brass strip as shown in Figure 67. Figure 68 shows the completed mechanism including the arrangement of cranks and linkages along the jib.

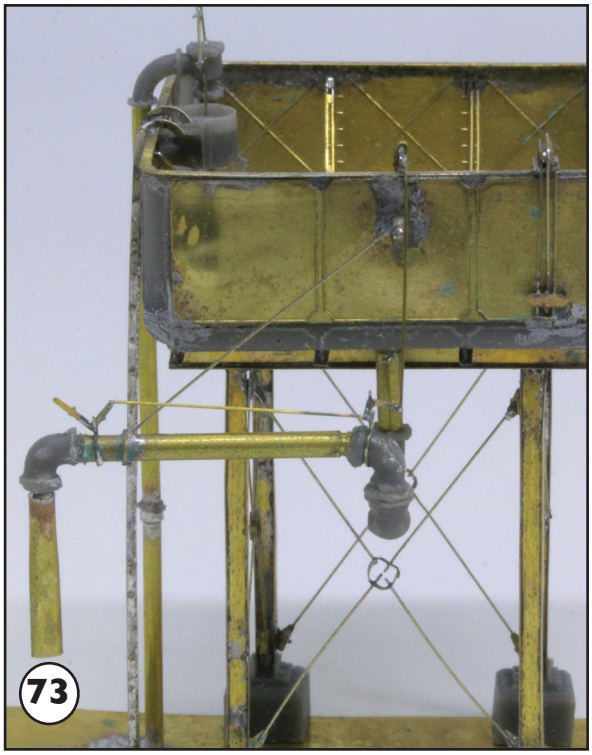










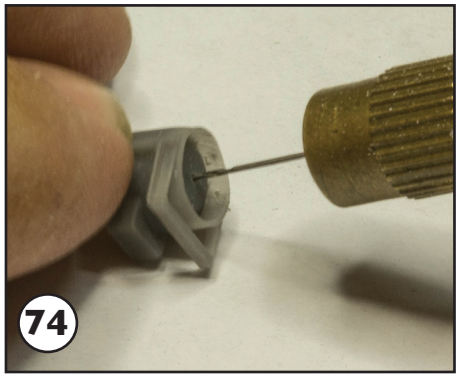


Figures 69-73 provide additional illustration of the arrangment of the jib, connections to the fulcrum brackets, and linkages.

C2 Tank Internal Details

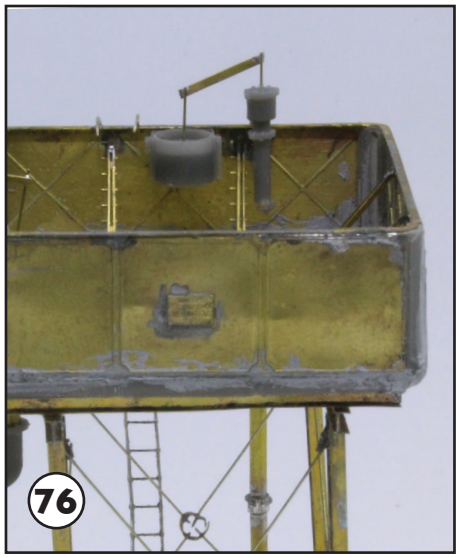
Water tanks were refilled from the source (which could be a town water supply, council dam, railway dam or nearby river) piped underground to the tank. A supply pipe from the main ascended to an "equilibrium valve". A float was coupled to the equilibrium valve and when the water level fell to a pre-determined point, the float would cause the equilibrium valve to open and admit more water into the tank. The outlet pipe was similarly piped to an underground network of pipes which were connected to water columns. In the case of a jib, the water was directly taken from the tank. A valve on the bottom of the tank could be opened by a lever controlled from the ground via a ground rope or by a lever on top of the jib which the crew could operate. Another float was connected to a gauge on the outside of the tank via a wire rope over a pulley. Therefore, the gauge would be at the bottom of the tank when the tank was full and nearer the top when the tank was empty.

C2.1 Drill a 0.4mm dia hole in the top centre of the equilibrium valve float 2mm deep, as shown in Figure 74.



C2.2 Drill a 0.4mm dia hole in the top of the centre of the Equilibrium Valve 2mm deep, as shown in Figure 75.

C2.3 Insert two lengths of 0.31mm wire into the float and equilibrium valve as shown. Solder or glue a piece of brass strip between them as shown in Figure 76.
Note that this float is guided within the cylindrical float bracket. The height of the float assumes a near full tank.

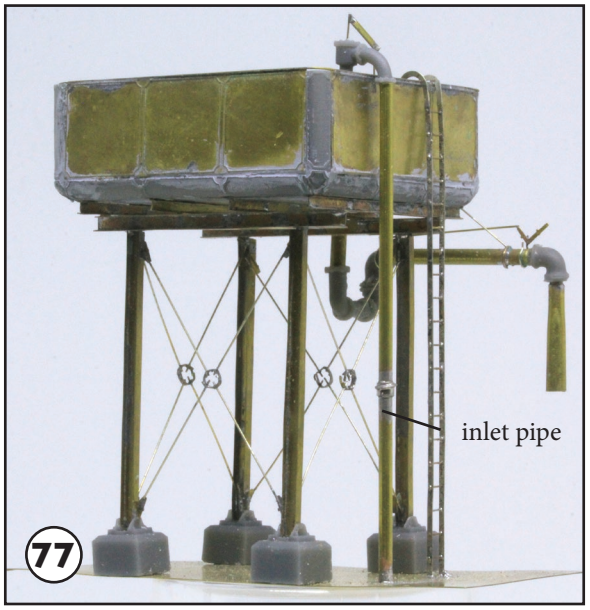


C6 Tank Inlet Pipe

The tank inlet pipe is a 6” cast iron pipe represented by a length of 2.5mm x 2.0mm brass tube attached to the inlet elbow of the equilibrium valve. Figure 77

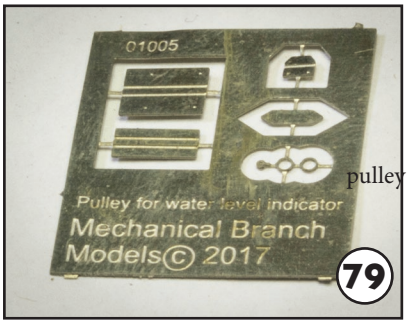
To represent lengths of cast iron pipe with bell and spigot joints, a short piece of 3.0mm x 2.5mm tube can be soldered 42mm (12’) from the top pipe flange. Figure 78.

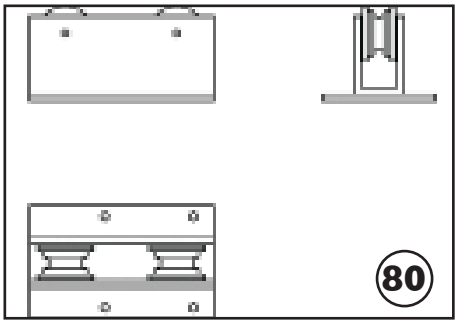
As a guide for the pipe length, the top of the tank to the top of the footings should be 19’-11” (66.2mm) for a single tier tank or 24’-1” (84.3mm) for a double tier tank.

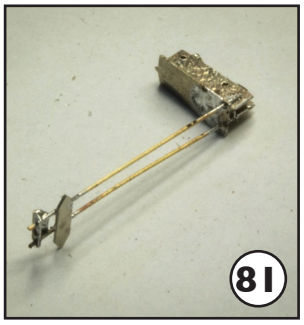


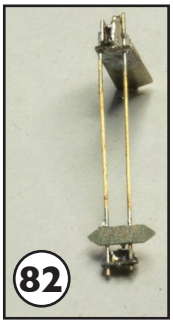
C7. Water level indicator

C7.1 The etch (figure 79) comprises a flat base, a second, narrower rectangle which is folded into a “U”, and an indicating plate and slider.









C7.2 The pulley assembly is shown in Figure 80.

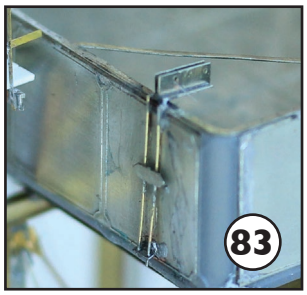
Drill out the four holes in the base and the two holes in the slider, to fit 0.3mm wire. Fold up the channel and solder to the base. Fitting pulleys is an optional detail.

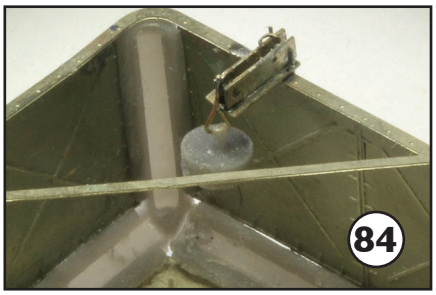
C7.3 Fold the slider into an “L” shape. Cut two 15mm lengths of 0.3mm wire and solder into the holes in the pulley base and slider as shown in Figures 81 and 82.

C7.4 Solder the pulley assembly to the top edge of the tank as shown in Figure 83.

A full tank would be indicated by the indicator plate at the bottom of the tank. Figure 83 shows a tank approximately half full.

C7.5 Cut a length of 0.15 wire to the float so that it will sit at the desired water level in the tank. Glue the wire to the float. Glue or solder the wire to the pulley assembly. This is shown in Figure 84.





5. Painting and weathering

5.1. Ensure the tank is clean, free of loose material, grease and flux. Paint with a self etch primer. When dry, remove any imperfections and fill any gaps. Sand smooth. (Figure 85)

5.2. The tank and steelwork were painted a mid grey. Refer to photographs to match the colour. Successful results have been obtained with Vallejo Model Air Acrylics, where Deep Sea Grey was used. Building up colour with several coats is more effective than one or two heavy coats. Paint the footings to represent concrete.

5.3. Photographs from the 1940s and 50s show that tanks were often well maintained, however at that point many were less than ten years old. As would be expected with an outdoor structure holding untreated water, tanks became rusty and stained with salts. The cast iron panels were sealed to each other with a compound containing iron filings so that any leak would cause the formation of the oxide and seal up the leak. Therefore, rust and salt stains often formed along the joints between panels.

6. Final Details

6.1 Representing water in the tank

Prepare the inside of the tank by painting a mid-brown (see figure 86), with highlights to represent rust and silty water. Tide lines are common around the inside of the sides of the tank. If desired the tank can be filled with a clear resin. I recommend Barnes Products EpoxyGlass ultra-clear resin. This product can be tinted if required. Ensure any holes or gaps in the tank are filled before pouring in the resin.