

Ursus

Marine Service

Metal Yacht Kit
Development & Supply
Technical Support
Custom Designs

METAL KITS ASSEMBLY INSTRUCTIONS



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1: INTRODUCTION.

Throughout these instructions we will use the word metal which may apply to steel, aluminium or stainless steel. There will be variations between the handling of the various materials and these will be drawn to your attention as necessary. YOU WILL NEED TO READ and absorb all these instructions BEFORE you start the assembly of your kit. These instructions are intended to introduce you to building from a kit but are NOT intended to replace good metal boatbuilding practice. If you are not already a competent welder then please seek assistance.

Few of you will understand (or want to know!) the huge amount of work that is required to turn any boat plan in to a cut-to-size boat kit. Every part has to exactly match that of its neighbour, the slots need to be exactly in the correct locations and everything must fit perfectly together to enable you to complete the assembly of the hull, deck and superstructure with a minimum of problems.

The first thing to realise is that the kit differs in many ways from the methods you would use to build a metal boat from scratch. The kit is far superior to anything you could achieve by starting with the plans and delivery of raw steel plate and the various profile bars that are needed to build your metal boat.

Most metal boats built from scratch are built upside-down...most boats built from cut-to-size metal kits are built UPRIGHT. Not only is this a more appropriate way to assemble the kit but it saves cost and inconvenience of having to turn the hull.

To make sure that you take notice of one very important piece of advice, we will state it here as well as at the appropriate time:

YOU MUST TACK WELD THE COMPLETE HULL DECK AND SUPERSTRUCTURE TOGETHER BEFORE YOU RUN ANY FINAL WELDS.

Failure to observe this advice will almost certainly ensure you will end up with an unfair boat requiring a considerable amount of filler. In any case do NOT OVER-WELD or try and run long welds at one time.

2: RECEIVING YOUR KIT.

Depending on your location or delivery arrangements your kit may arrive on a flatbed truck or in a container. You should be aware of these arrangements before the actual date of delivery so you can make the necessary preparations to receive your kit.



The kits are normally packed with wooden blocks between the plate and on pallet(s) and can be lifted off the transport using a small crane, front-end loader or similar equipment. You may find it more convenient to "drag" your kit from the truck or container using a pair of planks as a ramp.

Once you have unloaded your kit you must make provision to keep it covered until assembly is underway. Make sure that the metal parts are not in direct contact with cement based floors like concrete, as this will affect the Sigmaweld primer.

You should go through the kit and identify each part or group of parts so you can store these in the order that they will be required. Due to the requirement of packaging for transport it is impossible for the kit manufacturer to stack everything in the order you will be using the various parts...you must take care of this. Later in this text we will suggest the order of assembling your kit so you will be aware of which parts you will need at each stage. If you do not find a particular part at this stage...DO NOT PANIC...there will be so many pieces that it will be easy for you to overlook one or two at this stage. If after several checks you find one or more parts missing then do contact the supplier of your kit so they may put the matter right.

3: ASSEMBLY SEQUENCE.

FOR MOST HULLS:

The first item you will need is the setting up jig. The transverse profile jigs will be supported by the metal "castles" that come as part of your kit. The setting up jig is intended to get the assembly of your hull started and is NOT INTENDED TO SUPPORT THE BOAT during the entire building process. After you have the bottom plates tacked together you should consider adding extra support and bracing to the structure.

For most hulls, the general assembly sequence is:

- Assemble the jig.
- Bottom plates into the jig, line up the markings for frames and tack weld together.
- Assemble web-frames in accordance with drawings.
- Position bottom longitudinal stiffeners on bottom plates (very small tack welds only).
- Position frame over longitudinal stiffeners onto bottom plates, starting with the middle frame, work your way aft ships and then from the middle to the bow.
- Tack-weld frames in position at the centreline of the bottom, working outwards.
- Tack-weld bottom longitudinal stiffeners to web-frames
- Insert side longitudinal stiffeners into web-frames.
- Position side-hull plates starting at transom and tack weld to web-frames only.
- Tack weld longitudinal stiffeners to side and aft-hull plates.
- Position rear hull panel (transom) and tack-weld to bottom and side plates.
- Position longitudinal deck-stiffeners and tack-weld to web-frames.
- Position deck-plates starting aft and tack-weld to web-frames only.
- Tack-weld deck-longitudinal stiffeners to deck plates.
- Position superstructure walls and tack-weld to web-frames.
- Position and tack-weld roof-plates to deck.

This is the recommended sequence for most type hulls. Depending on the facilities of your workshop and building site, variations may be required or preferred. The better equipped your workshop is with overhead lifting equipment and equipment the easier and more smoothly will your job proceed. We do recommend that you read some of the literature available on metal boat building, which will answer many of those general metal boat building questions that are sure to need clarifying as the project proceeds, if only to get familiar with the terminology of parts and components of your kit. Contact your supplier for titles available in your area.

FOR HULLS WITH LONG KEEL TYPES:

Some motor and sailing yachts and other similar hulls are unusual in that the keel structure should be assembled at the same time as the bottom plating. Take care that you do not "squeeze" in the tops of the keel, use the webs as spacers. After you have positioned the bottom plates, the keel sections and the transverse profile jigs in their correct location you may start to tack weld the bottom plates to the keel sides.

FOR SAILBOATS WITH FIN KEELS:

Sailboats with deep keels will have the keel installed after the hull is completed. The "canoe body" should be built from the bottom of the hull upwards in a similar manner used to assemble a powerboat hull. The webs will be arranged so you can later add the keel after raising the hull into the correct elevation.

The idea of this method is to allow you to work on the hull deck and superstructure while the boat is lower and thus more accessible. The exact method and order of assembly may depend on the availability of lifting equipment and your general work environment.

FOR POWERBOATS:

In most cases you can start by laying the bottom plates in the transverse profile jigs and with the aid of the "castles" so position the plates that you can start to tack the hull plating together along the centreline. You will next be able to install the bottom sections of the frames and webs in their correct location.

5: WHAT YOU NEED TO KNOW ABOUT WELDING

Attempting to construct a metal boat kit leads us to believe that at least the basics of arc and or Co2 welding are known. If in doubt about your abilities to weld , improving your skills on some scrap pieces of metal would be advisable as there are no great secrets in general steel welding but practising would set you of to a good start right at the beginning.

Welding aluminium or stainless steel should not be attempted without proper knowledge of the materials and welding sequences involved and should always be carried out in a covered and clean surroundings.

The metal kits are constructed in such a manner that the strength of the hull & deck is created from the build up of the frames and stringers as interlocking sections , HEAVY AND CONTINUOUS WELDING OF FRAMES AND STRINGERS SHOULD BE AVOIDED AT ALL TIMES.

Especially important for all plate joints during the assembly of the hull is DO NOT APPLY CONTINUOUS WELDS. The plate joints should be ONLY TACK WELDED in three or four locations, one weld at the each of the ends of the join and one or two divided over in the join. These tacks should be no more than 2 inches or 50mm long. If you weld the plates on the floor you will end up with a "hard-spot" in the hull plating.

All parts of your kit are cut to a precision of 2 mm and earlier models are designed to be welded together without any opening between the parts whilst later models are designed with a 2mm gap between joins. Some plates will need to be bevelled before tacking in place or you may prefer to make the bevels after you have tack welded the plates and just before running the final welds. In all cases good metal boatbuilding practices will prevail.

After the hull & deck are COMPLETELY TACK-WELDED together , the process of finishing welding can take place. The secret of creating a fair hull & deck after tack-welding is completed is to use a fairly high amperage and speed setting of your welding equipment. Welding with too low amperage and slow speed will create lots of heat on the spot and less penetration of weld material in the seam, causing strength problems and lots of grinding weld material away to obtain a smooth surface afterwards. This in turn would weaken the weld again.

Using common sense and practise should leave you to create a smooth and fair hull & deck structure with very little distortion. IF IN DOUBT ABOUT YOUR SKILLS , SEEK ADVICE. Any metal construction company or competent welder can help you with the basics.

Always observe personal protection and safety regulations.

6: ASSEMBLING YOUR KIT.

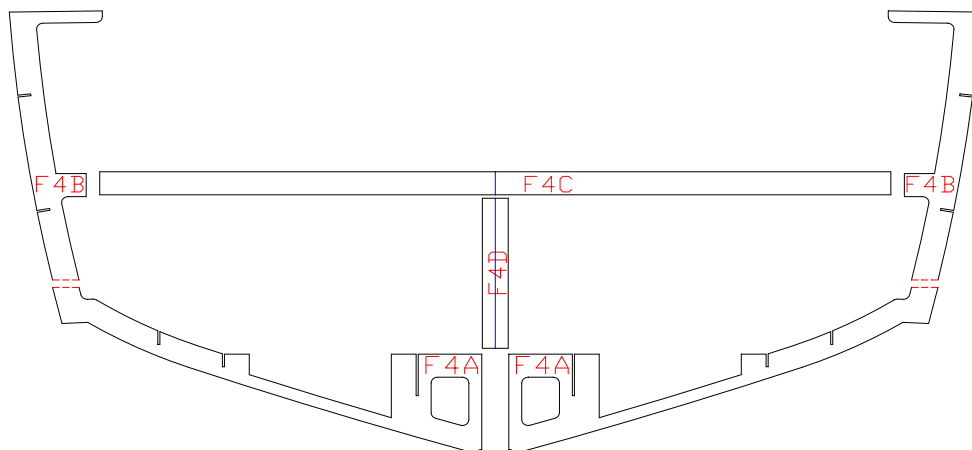
With the arrival of your metal kit, you received a packing list containing the names , numbers and quantities of all the parts in the metal package.

Furthermore you received one or more large scale drawings showing all the parts as flat surfaces and more or less grouped together as they appear in the metal kit and a number of small drawings showing the assembly of the frames with the appropriate measurements.

Studying the large scale drawings will give you a first insight in the position of the various parts and it becomes apparent that the numbering is as much as possible a logical sequence of the way the parts assembly progresses.

Prior to using these drawings , we advise to make some copies of the drawings or parts there off or cover them with plastic as they could easily be destroyed during the construction and welding. Using the packing list and the drawings you can now make a check to see if all the parts are present.

For ease of recognition you will find that frames etc. are numbered with 4A,4B,4C etc. thus every time you find a number 4 and extension A or B etc. , they belong to the frame no.4.



In the above shown typical drawing it is easy to see how collecting the numbers will almost automatically bring a frame or part together.

Now you have collected and sorted all the parts , the frames can be tack-welded together by using the small drawings and the given measurements as reference.

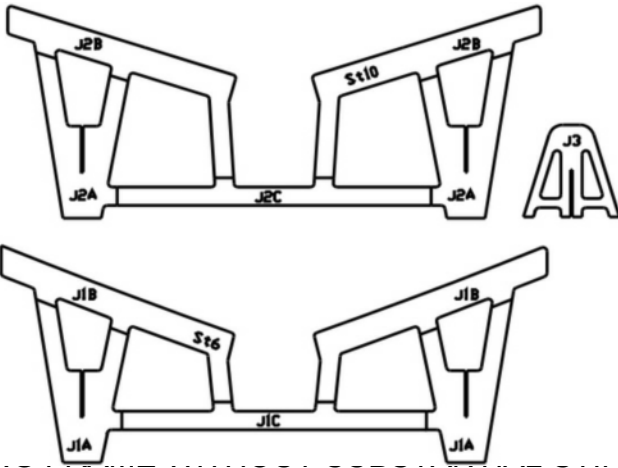
Prior to welding , use an angle grinder and create a "V" of aprox. 60° at the seam to be welded. This means 30° angle at each plate edge. Doing this will give you better penetration of the welding material and more strength.

We use the word tack-welding again as it would be tempting to finish welding the seams fully.

On larger boats it might be an advantage to only weld the bottom parts of the frames together and put the side frames up after the frames are in place on the bottom plates. Your own judgement is important here.

Having prepared all the frames in this manner it is now time to prepare the building jig. With the metal kit you have received 2 or more jig parts as shown below.

Having prepared all the frames in this manner it is now time to prepare the building jig.
With the metal kit you have received 2 or more jig parts as shown below.
Weld all supplied jig parts together as shown in the picture below.



supports and CANNOT BE USED AS FULL BUILD-ENING AND CROSS BRACING.

The supplied jig parts could be placed on a concrete underground , levelled and stiffened.
in case no solid underground is available, the use of a couple of heavy RSJ's picked up from a local scrap dealer could do the trick. The distance between the jigs is determined by the position of each frame (web) in the hull, whereby the jig number is the same as the frame number (f.e. Jig-part J5-2 is at frame 5).
In case the "jig" parts stay in place during the entire construction , it would be advisable to tack-weld a flat bar across the top of the plates to spread the point loading and avoid possible damage to the hull plating.

Now place the bottom plates on the prepared jigs or building frame and tack-weld together at a number of points.
We refer here to paragraph 2 in relation to particular motor and sailing yachts where also the keel is placed under the bottom plates at this stage.

For those of you who are new to this type of boat building , having placed the bottom plates on the jigs , it seems they are never going to fit.
Start tack-welding at the location roughly in the middle or somewhat aft of the middle after lining up the lines on the plates and position of the plates.
When you now go forward or backwards from the tack-welded position you can help the plates get in shape by having some helpers pull up the sides and using a trolley jack underneath the middle join of the plates until the seams touch. Now tack-weld at this point and go to the next position. At the bow you would probably need a hand block and tackle to pull the sides of the plates together as some tension will be experienced here.
DO NOT FORGET TO SECURE THE POSITIONS OF THE CLAMPS AGAINST SLIDING AWAY.

Having finished tack-welding the bottom plates together, start placing the longitudinal stiffeners at the markings on the bottom plates whilst lining-up the slots with the position of the frames (webs), as indicated by lines on the plates and use the large scale drawing(s) as reference. Only tack-weld these longitudinals to keep them in place for the time being. As frames will have to be slotted over these longitudinals, we recommend to tack-weld only to the bottom plate in the middle between frame positions, which allows you to align these when putting the frames in position.

Then start placing the frames (webs) which slot in the longitudinals. Position the middle frame first and tack-weld it to the bottom-plates in the centre, then pull up the bottom plates towards the frames until they fit snugly and tack-weld.

Depending on the shape of your hull, we recommend to work your way aft ships first, thereafter from the middle to the bow.

If you have put the frames together completely, use some temporary bracing on the upright sides of the frames as they are likely to flop about a bit.

The picture below shows you clearly what we described above.



Now we place the stringers in the slots of the frames on the sides and slightly tack-weld at some spots to keep them in position.

We do emphasise again, ONLY TACK-WELDING.

At this stage you have already created a strong and solid base of the hull and the time has come to bring the side plates into position. This is best done by using a simple overhead gantry or the use of a forklift truck.

Pick up the side plate(s) by using a plate clamp on a chain connected to a block and tackle or forklift leg, make sure the plate is more or less in balance when it is hanging in the air and bring to its allocated position.

Use a helper to put a point of the seam in the right position and tack-weld .
Continue by moving the plate up or down a bit with the block and tackle until the entire side is in position and tack-welded. Place some tack-welds on the uprights of the frames as well.
The side plates nearer to and at the underside of the bow will show some tension and can be pulled in place by attaching a chain on the outside of the plates and pulling them into position.
To attach a chain and/or block and tackle to a plate , tack-weld a temporary eye or something similar to the plate. By only welding on one side of such plate(s) , you can easily remove these again by bending this plate until the weld breaks.

Note: In the case of radius chine sailboats , the radius chine sections are not used at this stage , we will come back to those later.

Next the transom plates , bathing platform where applicable , stern plates and all other plates belonging to the hull are offered up in position and tack-welded in position.
Especially where rounded corners are used , offer the particular plate up to the position it is to be used and check or make the correct radius in the plate prior to tack-welding.

REFER BACK REGULARLY TO THE DRAWINGS AND CHECK INTERMEDIATE AS WELL AS OVERALL DIMENSIONS.

Now the deck plates , superstructure , fly-bridge where applicable and all other super structure plates can be offered up to the hull and tack-welded into position using the gantry or forklift truck to lift them onto the hull.
Do make sure the support strip(s) under the deck and cabin roofs , where applicable , are placed first in its slot(s) in the frames and beams.

In those cases where professional lifting equipment and space is available , an option would be to tack-weld the superstructure together at floor level , braise temporarily and than lift the entire sub structure onto the hull.

FOR RADIUS CHINE HULLS:

Having tack-welded the entire boat together , you now turn your attention to the radius section(s). We have supplied you with the appropriate amount of section to fit in the left over opening in the hull.

As you checked the metal kit on delivery , you have seen that the radius section plates are rolled in the required shapes to fit the hull.

Now you can carefully hold a section against a position on the opening in the hull and using a helper position each plate in the correct position. Although the radius plates are rolled to patterns which match the hull shape, some plates might need some pushing and pulling to make sure that the plates fit exactly to the frames.

Tack-weld into position and continue until all radius plate sections are in place.

CONGRATULATIONS , you are now looking at the shapely result of your perseverance.

Of course you have run into some difficulties during the building process and maybe even cursed a couple of times but it must be clear by now why we told you time and time during this manual ONLY TACK-WELDING. Any possible mistake you may have made was fairly easy to rectify as you only had to grind a couple of small welds away.

7. FINISHING THE ASSEMBLY.

Now the time has come to finish the welding process.

Firstly , finish welding all the seams between the frame sections applying a full weld. All slotted connections between frames and bottom and side longitudinals are to be welded in full on at least two opposite sides of the connection.

Then apply intermittent welds on all frames and stringers to the hull and superstructure plating using the rule 50 mm. (2") weld , 150 mm. (6") clear , 50 mm. (2") weld. Alternate the weld one side of plate , other side of plate and so on.

DO NOT CONTINUOUSLY WELD ON ONE SIDE OF THE HULL but weld a bit one side , the other side and so on to avoid pulling. Do not underestimate the forces coming free when welding.

Now the hull should be welded.

In case you have not made a 60° "V" between the seams of the plates yet , no problem , use an angle grinder and cutting disc and cut a groove in the plate where the seam is.

Not as nice as having a "V" made first but the result will be the same.

As explained before , alternate welding from side to side and finish the welding process.

The hull under the waterline must be welded inside and out. All other welding can be done one side only.

Grind away surplus welding whereby we advise to pre-grind the welds with a heavy duty grinding disc and finish grinding with one of these softer flexible discs , ready available in the trade , to avoid having to use filler on the weld seams.

Clean the surface and apply a coat of primer and the basics of your pride and joy are ready for finishing.