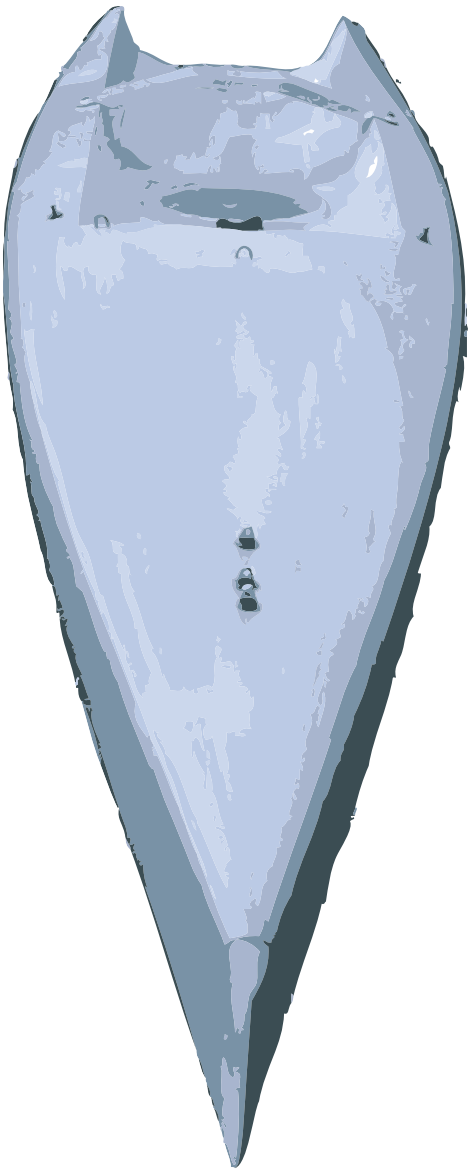


TS3
Instruction Manual

Version 1.0

Introduction

This manual is designed to help you get on the water and then provide setup settings to help you tune your TS3 to be competitive. I hope you enjoy sailing your new boat.

Many of the illustrations used in this manual have been thankfully provided by Craig Smith from his TS2 Rigging guide.

Assembly of a new boat

The basic boat comes essentially complete. The only tasks required to get on the water are to:

a. Attach the keel, bulb, rudder and mainsheet loop;

b. Install the radio control equipment (receiver, steering servo, battery, winch and switch);

c. construct the rigs;

d. rig the boat and go sailing.

Attaching the keel, bulb rudder and mainsheet loop

It is easiest to attach the keel and bulb first by plugging the keel base into the bulb and screwing in the bulb attachment bolt.

The keel is then attached to the hull with the keel bolt.

The rudder shaft is inserted in the rudder tube, the rudder control horn attached to the rudder shaft and the locking bolt tightened to ensure the rudder will not fall out. The rudder shaft has a flat which the locking bolt is tightened against.

The mainsheet loop is attached with the stainless steel self taping screws provided.

Install the radio control equipment

This involves installing the receiver, rudder servo, battery, switch and winch. The type of radio equipment is fairly personal but the boat is setup for standard size steering servo and I use the Lithium Polymer batteries due to their small size and low weight.

Installing the rudder servo

The servo is installed in a servo tray, the snap on E/Z connector (Dubro p/n) is put on the servo arm and then the tray is slid into the servo mount and held in place with the retaining screw. The servo tray is designed for a standard size servo and I normally replace the standard screws that come with the servo with stainless steel fasteners.

Optional sealing of the servo case

As the servos are mounted very low in the boat it can be an advantage to seal the case to help prevent water getting into the case in the event of a leak. The type of servo you use will determine if this is worth doing.

For example, Multiplex servos are built with the lower portion of the case as a one piece moulding and the assembly screws come down from the top. The wires exit the case half way up the casing. As a result it is unlikely that water would get into this type of servo from a minor leak. Most other brands of servos however have their wires exiting the case at the bottom, the assembly screws come up from the bottom of the case and the case is sealed at the bottom via a base plate. These servos are more susceptible to water ingress and could benefit from additional sealing.

Various electrical potting compounds are available for this task but the one I use is StarBrite's Liquid Electrical Tape (www. starbrite.com).

Pushrod alignment

It is important that the steering pushrod (1/16 inch stainless steel welding rod) is essentially unloaded through the cockpit exit tube when the rudder is centred. The alignment is affected by the position of the pushrod in the steering servo control horn and the rudder control horn. The get the alignment correct with your setup you may need to bend the pushrod being careful to ensure that you do not kink the pushrod where it will pass through the exit tube. When you have the alignment correct I frequently use a drop of bicycle chain oil on the pushrod where it passes through the cockpit exit tube for additional lubrication.

Centring the rudder

Centring the servo is achieved by zeroing the rudder settings on your transmitter, then holding the rudder in the middle of the boat while tightening the screw on the top of the snap on E/Z connector on the servo arm.

Rudder travel

At the servo end of the rudder pushrod I normally use a standard servo with a control horn that has a hole 20mm out from the servo drive axis. At the rudder shaft end I use the Dubro Steering Arm (Dubro Part Number 155) with the pushrod in the second hole out from the rudder shaft.

This setup provides approximately 35 to 40 degrees movement either side of the centreline.

Installing the winch

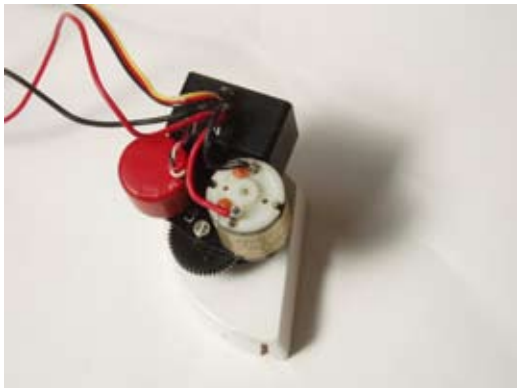
Winch options

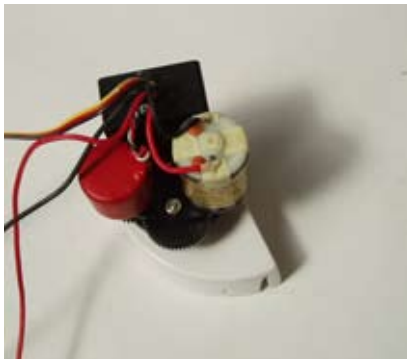
There are three brands of winches frequently used with the RMG280 being the most common with the Whirlwind and Hitec servo arm winches being used in lesser numbers. Installation of the RMG280 is the easiest of these with the Hitec servo arm being the most difficult. The sections below will show the installation of the RMG280 and Hitec Servo Arm winch while the rigging guide section contains drawings for the installation of the Whirlwind winch.

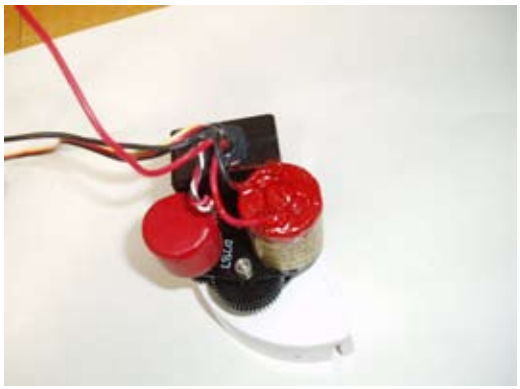
Optional sealing of the winch

As with the steering servos the winches are mounted very low in the boat and can benefit from additonal sealing.

In the case of the RMG 280 winch, the bottom of the motor is the area requiring additional sealing. I use light masking tape to cover the bottom of the shaft, electrical tabs and holes and then I cover the tape and part of the motor case with the electrical potting compound.







As for the other winches I only consider sealing the wires that exit the case and the bottom join on the case.

Winch Cup Installation

This is used for the RMG 280 and Whirlwind winches. Setup the winch in accordance with the winches manual to provide 300mm travel. Attach the winch into the base of the winch cup. Install the winch cup in the boat with the stainless steel self tapping screws (#4 x 3/8 inch R/H Phillips) making sure that the sheet tube fits into the slot at the rear of the winch cup. Adjust your transmitter (via the servo reversing function) to ensure that the winch drum turns clockwise when sheeting the sails in from a running position to a closehauled position.

Switch installation

The switch is mounted in the switch plate shown in the photo below.

The switch is a mini toggle with a water proof hood

Hitec Servo Arm winch installation

Some people chose to use a Hitec servo 5735 as a winch by attaching a lever arm to the top of the servo with a reverse pulley purchase system attached to the lever. In the TS3 this installation requires a reverse 3:1 purchase system attached to a 95mm lever arm. The photos below show the winch being installed, and then in the closehauled and downwind positions.

Battery installation

The battery is held in place on the port side of the keel case by Velco ™ . You need to attach loop Velcro on the battery. The hook portion is already attached to the keel case. I use Velcro with adhesive backing for this task and wrap it around the whole battery.

When using a Lithium Polymer battery I use the low battery sensing feature of the RMG280 winch as I understand that Lithium Polymer batteries do not recover if run completely flat. Although the RMG280's low battery sensing feature is intended for NiCad batteries it helps with the Lithium Polymer

batteries as well.

Battery Connectors

There are a range of connectors that people use in their boats. I use one of the following two types of the connectors on my boats.

I have settled on these connectors based on their material construction, size and rated power. Additionally, the type of connectors your fellow sailors use could also influence your decision as that way you can share batteries if you or they have a problem.

The square connectors are produced by Anderson Power Products (pn 1327 for red housing, 1327G6 for black and 1331 for the contact) or REMA (pn 80120-00 for red, 80120-01 for black and 80093-02 for the contact). These are available from Farnell and RS Components as:

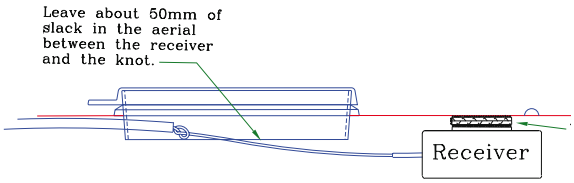
	Farnell	RS Components
Red Housing	397-3840	534-985
Black Housing	397-3864	534-979
Contact	397-3906	534-963

The round connectors are produced by binder and come in a version with strain relief (preferable) and without strain relief. Farnell carry the version with strain relief and RS Components carry the version without strain relief. The respective part numbers are:

	Farnel	RS Components
Round socket with strain relief	PF150540	
Round socket w/o strain relief		RS-464-397
Round plug with strain relief	PF150496	
Round plug w/o strain relief		RS-464-369

Receiver installation

The receiver is held in place on the port underside of the cockpit floor just ahead of the hatch opening by Velco ™ . You need to attach loop Velcro to the receiver (use the same adhesive backed Velcro that you used on the battery). The hook portion is already attached to the underside of the cockpit floor. The aerial is fed through the aerial tube which starts near the receiver installation location and exits the cockpit floor just forward of the Rudder Post Tube. A knot is placed in the aerial near the start of the aerial tube to prevent strain being placed on the aerial / receiver attachment point.



Construction of the rigs

Rig options

The main rig options center around the manner in which the mainsail is attached to the mast and as a result the type of mast tube used. The three main types of attachment methods are:

a. lugs on the luff of the main or a bolt rope which slides in the groove of a Bantock groovy mast;

b. a jackstay attached to the round mast section in the manner made popular by Graham Bantock (no one seems to use the traditional jackstay on IOMs these days); or

c. luff rings to attach the sail to a round mast section in the manner used for many years.

The choice of rig is a personal one with all being

successful at the top level. Generally you should use the type of rig your sailmaker is having the most success with as the sail shapes need to vary between rig types.

Tuning the boat

The goal of tuning the boat is to get the boat to sail itself effortlessly upwind with only occasional corrections needed for gusts or wind changes. Some people prefer to sail with slightly more weather helm than this, but that is up to yourself to decide the best setup for your sailing style.

Before the first sail

Ensure that your rudder is centred and that there is no hysteresis. If there is hysteresis there is either binding in the pushrod system or the servo has a problem. Check the alignment of the pushrod to ensure that it is not binding.

Setup the rigs with the following settings.

Mast rake

Initially setup the mast rake to the following rig dependant setting.

Number 1 Rig	1565mm
Number 2 Rig	1215mm
Number 3 Rig	975mm

These measurements are taken from the lower aft point of the mid mast band to the top mid point of the transom.

Mast bend

Generally we try to get the rigs fairly straight fore and aft. A slight bend of 2 – 5 mm is acceptable with the mast tip aft and the middle of the mast forward. This is very important for the 1-Rig as any more bend prevents the main boom going out in very light winds as a result of the combined action of the mast bend and leech and luff tensions.

Sail Twist

Mainsail Twist. The mainsail twist is controlled by the boom vang. To set the vang tension, hold the main boom up to the boats centreline with light pressure on the boom to ensure that the vang is loaded. The distance between the mainsail leech, at the end of the second batten, and the backstay should be between 35mm and 50mm. In flatter water and stable wind less twist is needed (35mm) with the twist increasing as the water gets rougher or the wind becomes less stable. Note: Make sure the mast strut was holding the mast while setting up the vang tension or else under sailing pressure the mast will bend forward prematurely easing the leech.

Jib Twist. The distance between the middle of the headsail leech and the topping lift is between 20mm and 30mm. The distance increases between the two in a similar manner to that of the mainsail – flat water tighter leech etc.

Jib and Main boom positions

The Jib and Main sheets should initially be setup to achieve the following positioning of the respective booms.

Main Boom. With the sheet control fully in on your radio control unit, the mainsheet is attached to have the main boom out 20mm from the centreline of the mainsheet loop.

Jib Boom. Once this position is set, hold the sheet line at the rear of the cockpit and pull it in until the main boom moves up to the centre line. While holding the sheet line in this position the jib sheet needs to be attached to have the leech of the jib at the foot 50mm from the fore decks centreline.

In normal upwind sailing the sails are set with the main boom out the 20mm set above.

Initial sail tuning

The goal in the initial sailing is to establish the correct balance of the boat. The boat is balanced when it will sail itself upwind in steady conditions with minimal or no intervention from the helmsperson. The best conditions to setup the boat is in smooth water with the wind in the middle of the rigs wind range. Approximately 5-8 knots for the Number 1 rig, 15 knots for the Number 2 rig and 25 knots for the Number 3 rig.

Starting with the setup described above adjust the mast rake to establish the correct balance. Move the mast rake forward to reduce weather helm and aft to increase it. With each change in rake remember to change the other settings (mast strut, main and headsail sheets, backstay tension and sidestay tension) to ensure that the rig is still setup the same as it was before you adjusted the rake.

It is important to remember the helm is also affected by the relative positions of the sails leeches and boom positions.

Understanding the rigs

Forestay Tension

Forestay tension is achieved through the combination of the backstay and sidestay tensions and the stiffness of the top section of the mast. The sidestays being

attached below the hounds help counteract the mast bending effect of the backstay so that you can achieve more forestay tension without over bending the mast.

The forestay tension also provides the headsail leech tension via the boom. In-sufficient forestay tension results in both excessive forestay sag but also early opening of the headsail leech as the rear end of the headsail boom lifts early. If the headsail leech opens too early the boat will develop weather helm as gusts hit.

Number 1 Rig

The main difference between the Number 1 rig and the 2 and 3 rigs is the addition of spreaders and the larger distances between the various attachment points.

The spreaders are setup in combination with the mast strut, backstay and sidestays to control the mast bend. No one control should be providing all the support for the mast. As an example if you find the strut is providing most of the support (with the vang off) then the spreaders need to be bent further forward to assist the strut. Conversely, if the strut is not loaded (with the vang off) then the spreaders probably need to be bent aft.

The larger distances between the various attachment points on the 1-Rig makes it difficult to achieve enough forestay tension via the backstay without over bending the mast. To achieve sufficient forestay tension most IOM 1-Rigs are setup with forward prebend of the mast tip (mast tip permanently bent forward) and then the backstay is used to bend the mast back to just aft of straight. The forward prebend is usually limited to the top 500mm of the mast. The amount of prebend used varies between sailors but I use the following as a guide.

Mast Type	Forward Prebend measured as the distance between a straight line from the top to bottom black bands and the forward face of the mast
11.1mm Groovy	8mm
11.1mm round Bantock	6mm
10.8mm round Hang Glider Battern	3mm

The greater the prebend used the greater the forestay tension and headsail leech tension you end up with. Too much tension (re prebend) prevents the headsail leech opening as the wind builds while too little allows the leech to open too early. The different amounts of prebend relate to the differences in the stiffness of each tube. The stiffer the tube the less prebend that is required to achieve the forestay tension

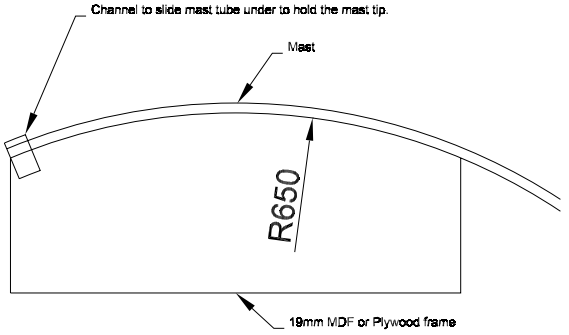
Prebending the mast.

Many people tend to prebend the masts with their hands. Our group finds this difficult to provide any measure of repeatability to the process. Instead we use a bending jig made out of MDF, Chipboard or Plywood (approx 19mm or ¾ inch thick).

We cut a curved radius along one edge (see figure below) and bend the mast around it being careful not to over do it. You put some type of hook at one end of the curve that will hold the mast tip. Hold the jig in a vice and slowly bend the mast around the curve. Release the mast and measure the amount of prebend and repeat until you get what you want. If you go to far, roll the mast through 180 degrees and bend it back.

The radius of the bend on the jig varies depending on the tube (diameter, temper and grade of aluminium). The table below gives the radius I use for a few common sections.

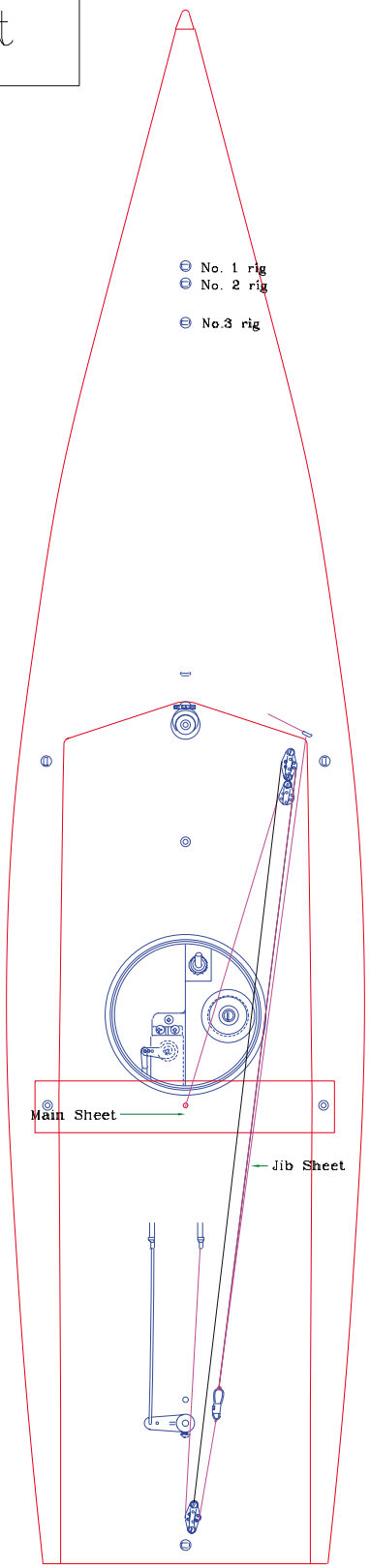
Mast Type	Radius
11.1mm Groovy	1800mm
11.1mm round Bantock	950mm
10.8mm round Hang Glider Batter	650mm

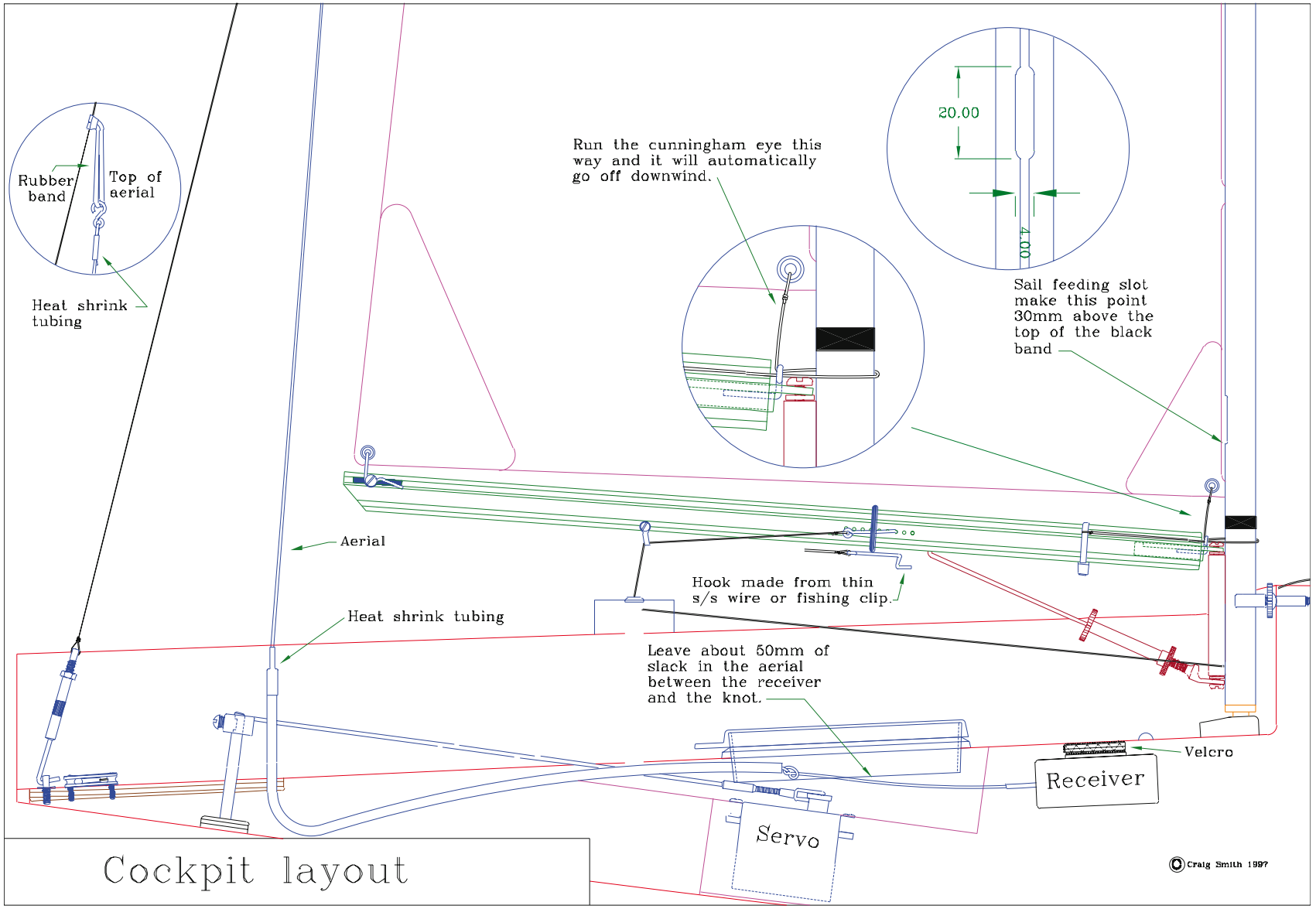


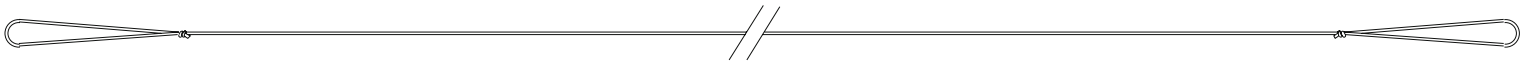
Rigging Guide

The following diagrams give measurements for setting up the rigs for the boat. Most of these diagrams have been provided by Craig Smith for modification and use in the TS3 rigging guide. They are guidlines only but should help you setup the boat competitively.

Deck Layout

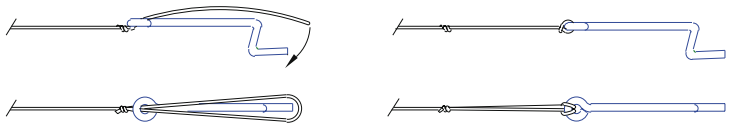



Rubber band
Top of aerial
Heat shrink tubing
Run the cunningham eye this way and it will automatically go off downwind.
20.00
4.00
Sail feeding slot make this point 30mm above the top of the black band
Aerial
Hook made from thin s/s wire or fishing clip.
Heat shrink tubing
Leave about 50mm of slack in the aerial between the receiver and the knot.
Velcro
Receiver
Servo
Cockpit layout
© Craig Smith 1997



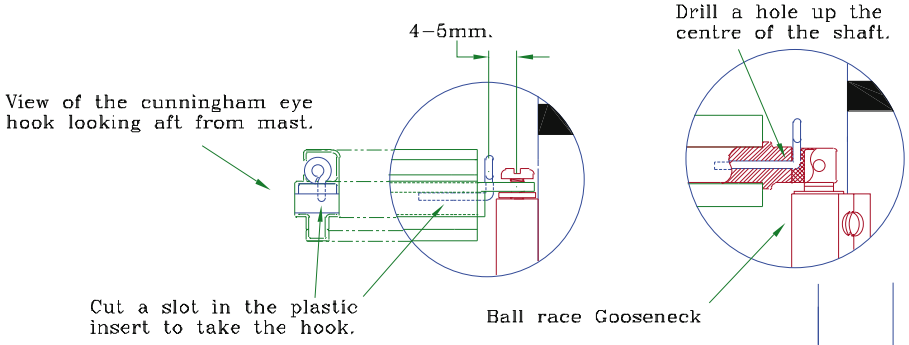
Make the loop at the end long enough to go through the eye of the sheet adjustment hook and right over its end. When pulled tight this knot will be easier to undo when changing sheets.

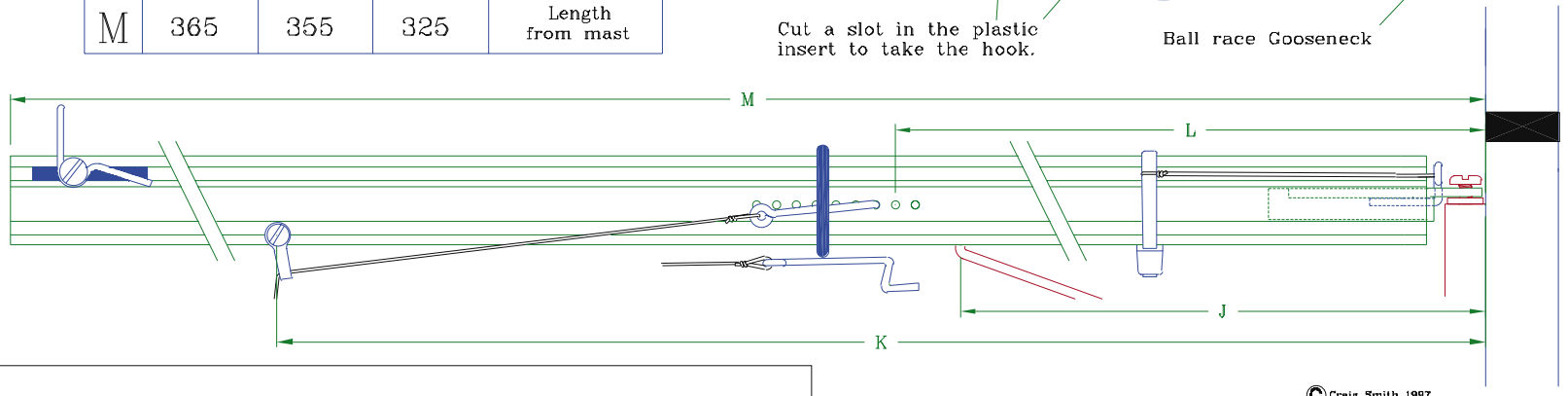
It's also a good idea to keep the loops in both ends of the sheets the same length, this way if a sheet breaks either end can be threaded through the eye of the adjuster hook.



Knot pulled tight.

Rig no.	1	2	3	Description
J	120	120	120	Hole for vang
K	240	235	230	Mainsheet Shackle
L	157	147	145	Holes for sheet adjustment hook
M	365	355	325	Length from mast



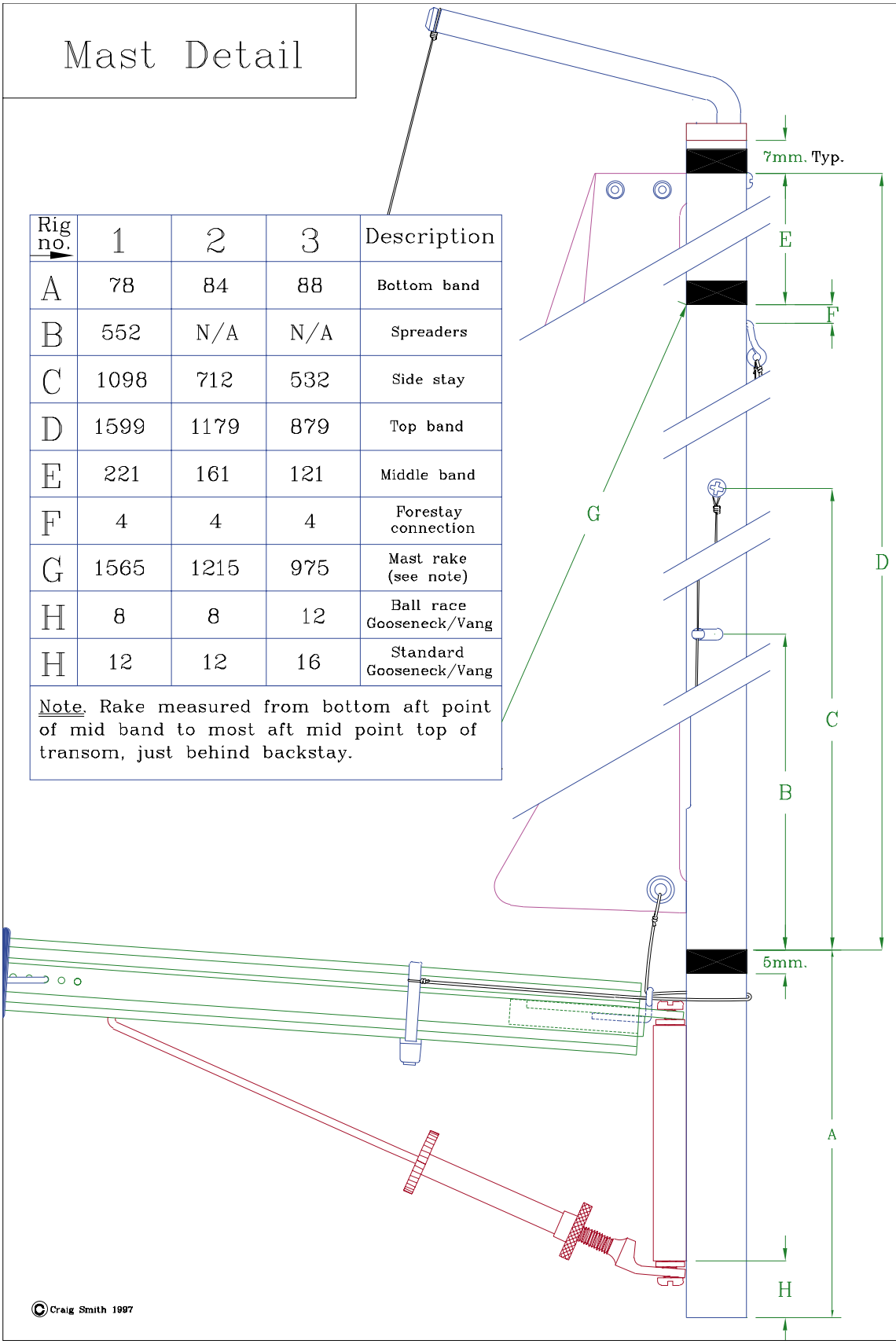


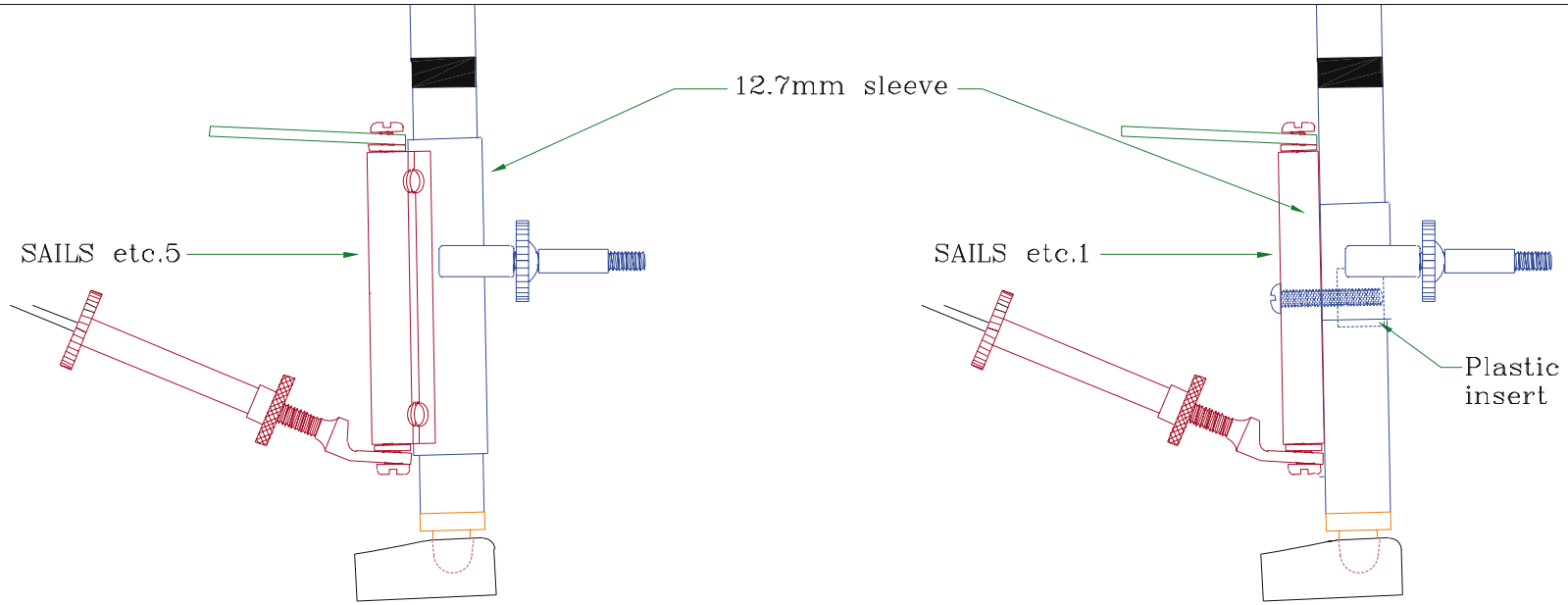
Main boom & sheets

Mast Detail

Rig no. →	1	2	3	Description
A	78	84	88	Bottom band
B	552	N/A	N/A	Spreaders
C	1098	712	532	Side stay
D	1599	1179	879	Top band
E	221	161	121	Middle band
F	4	4	4	Forestay connection
G	1565	1215	975	Mast rake (see note)
H	8	8	12	Ball race Gooseneck/Vang
H	12	12	16	Standard Gooseneck/Vang

Note. Rake measured from bottom aft point of mid band to most aft mid point top of transom, just behind backstay.

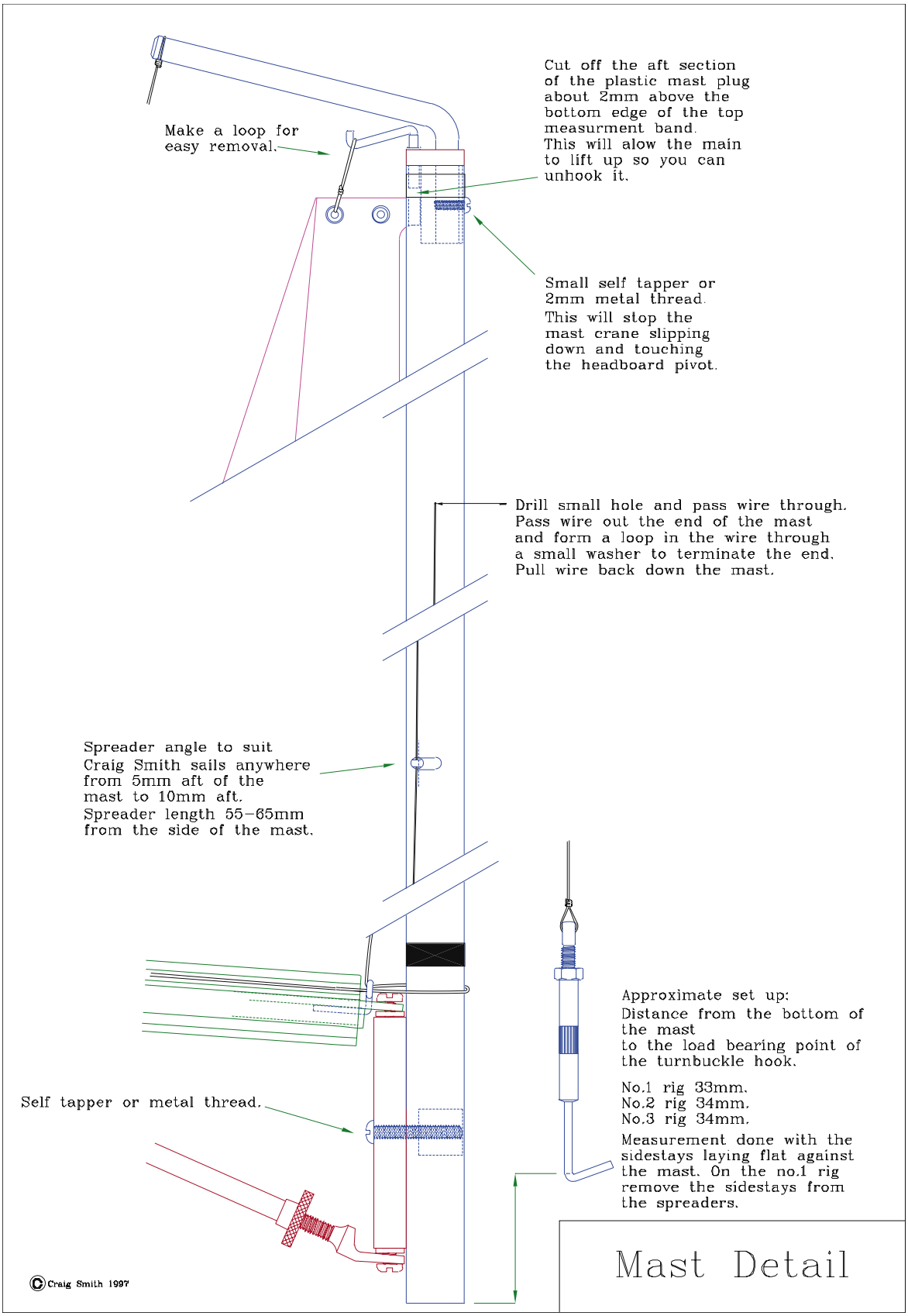


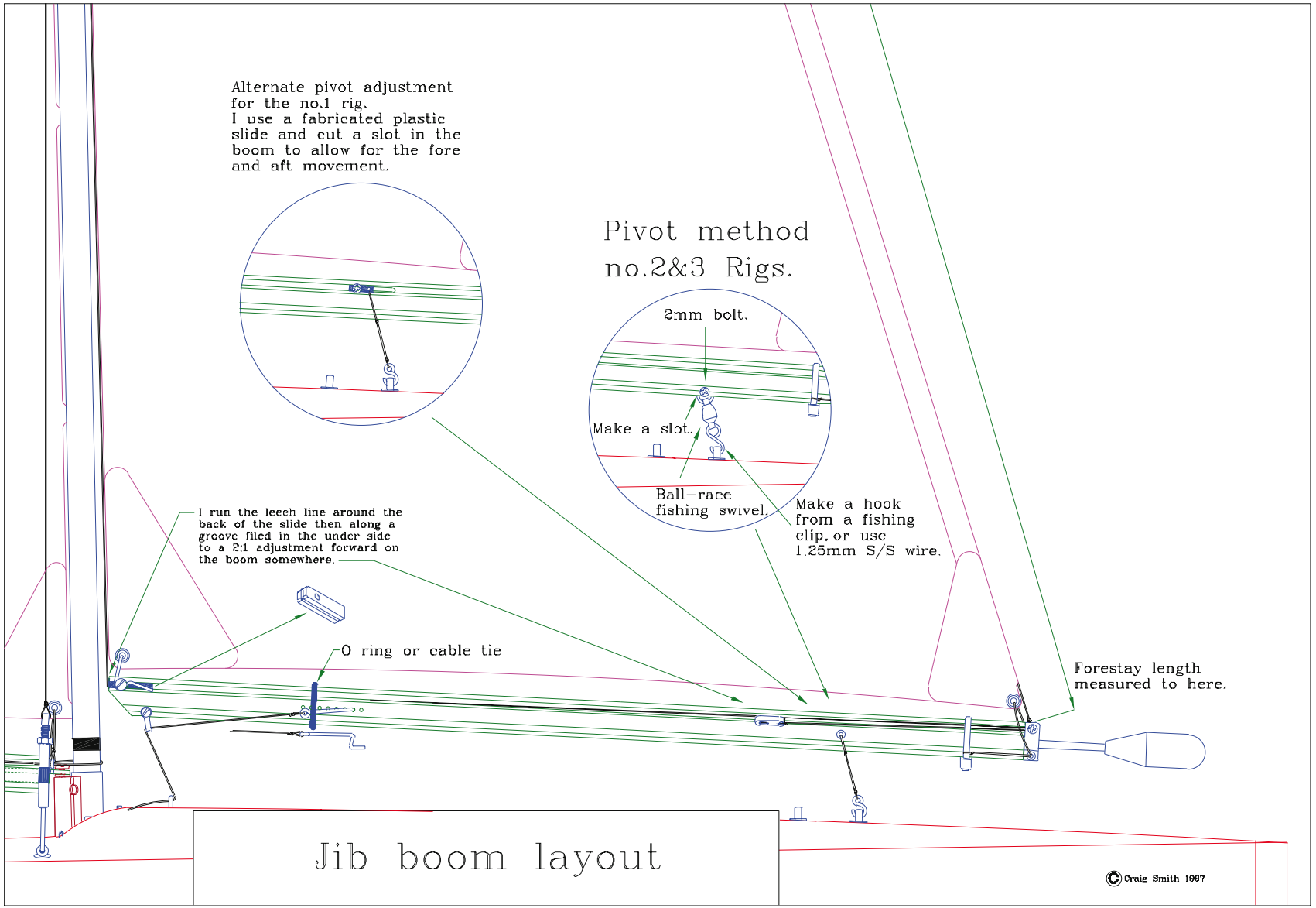


Gooseneck setup for 11.1mm mast

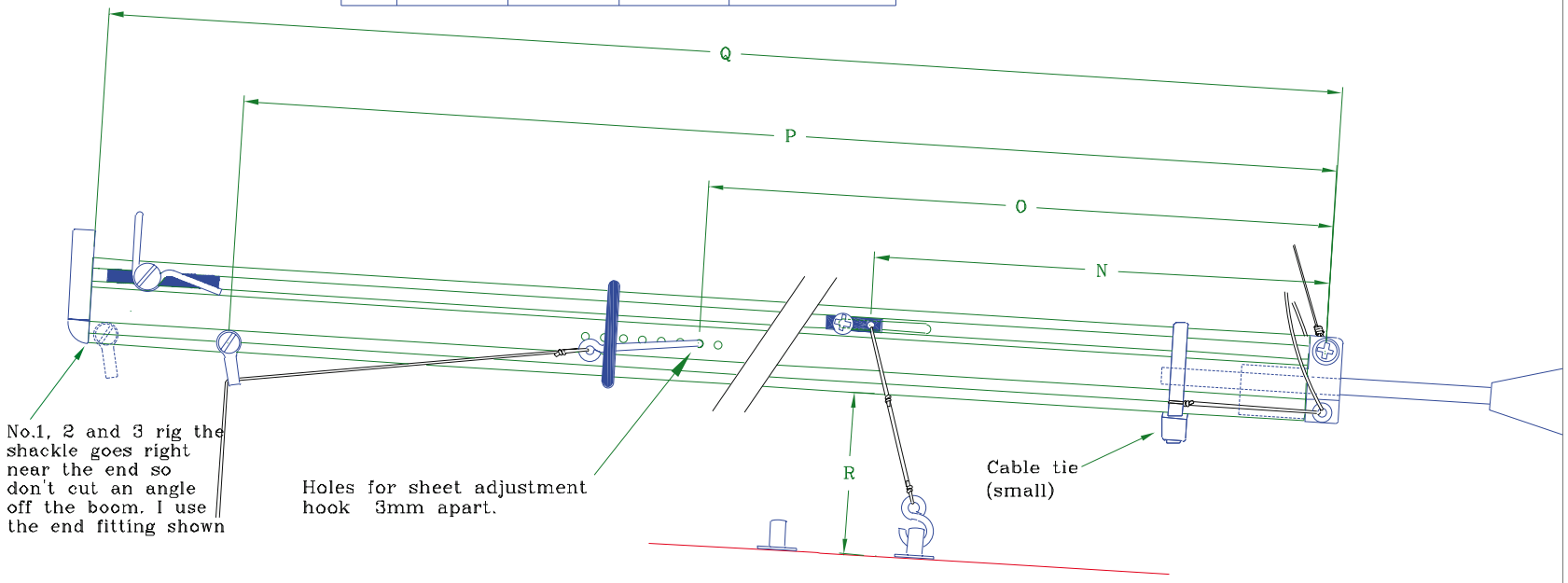
I prefer to use this method as there is a double thickness of aluminum for the screws to fasten to. Also you can just slide the 12.7 sleeve up over the mast without cutting out the back to allow for the other style of vang. The sleeve material is available from Radio Yacht Supplies in Queensland or use SAILS etc. 12.7 round mast section.
In the past I have used a piece of Easton .490" tent pole.

Some people prefer this style of gooseneck as it is more simple to install. I find the only disadvantage is that the fastening screw really needs a plastic insert to tap in to or over time the gooseneck will slowly work its way loose. The plastic sleeve will also have to be cut out to allow for the body of the gooseneck to slide up the sail track.

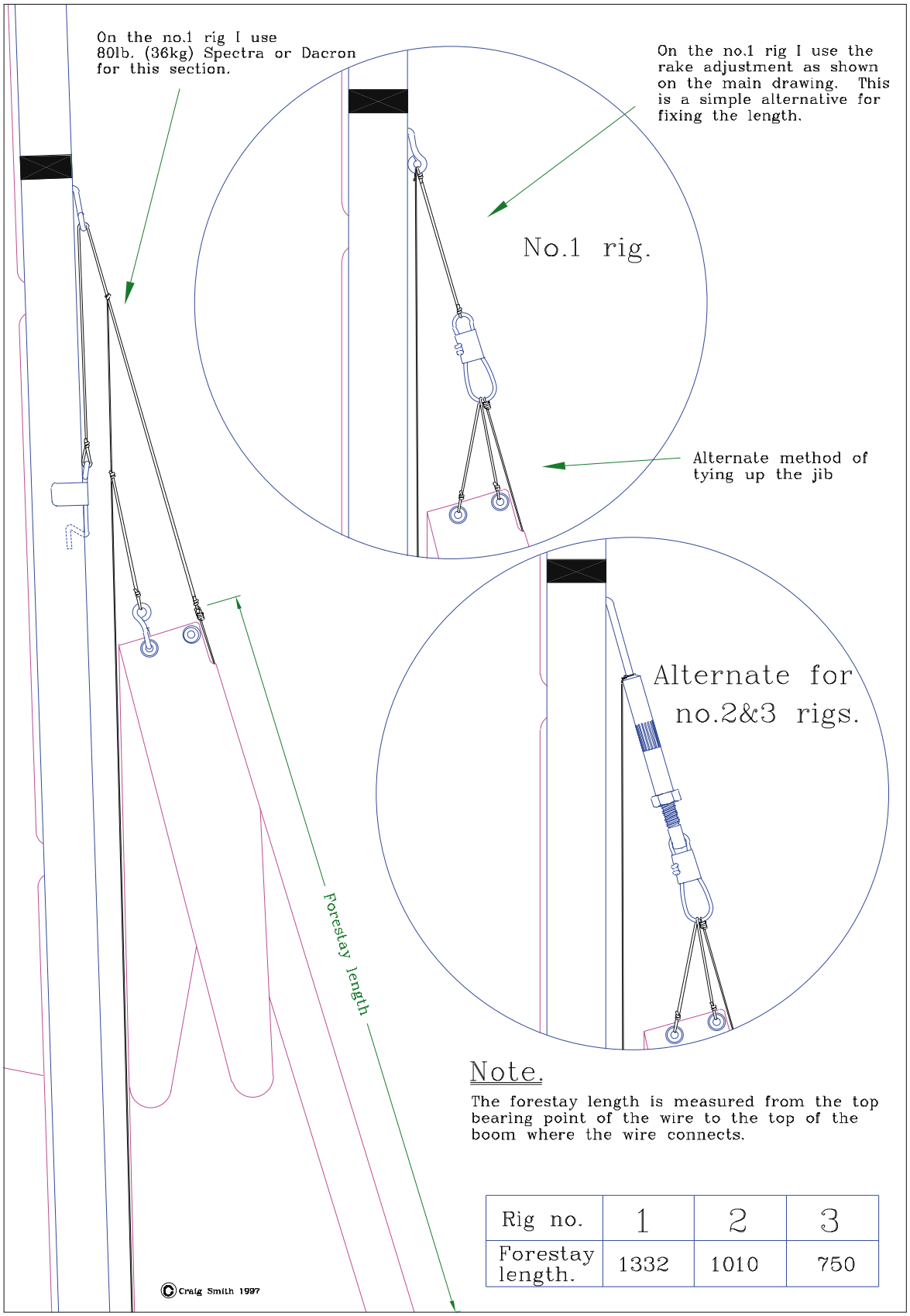

Make a loop for easy removal.
Cut off the aft section of the plastic mast plug about 2mm above the bottom edge of the top measurment band. This will alow the main to lift up so you can unhook it.
Small self tapper or 2mm metal thread. This will stop the mast crane slipping down and touching the headboard pivot.
Drill small hole and pass wire through. Pass wire out the end of the mast and form a loop in the wire through a small washer to terminate the end. Pull wire back down the mast.
Spreader angle to suit Craig Smith sails anywhere from 5mm aft of the mast to 10mm aft. Spreader length 55-65mm from the side of the mast.
Self tapper or metal thread.
Approximate set up: Distance from the bottom of the mast to the load bearing point of the turnbuckle hook.
No.1 rig 33mm.
No.2 rig 34mm.
No.3 rig 34mm.
Measurement done with the sidestays laying flat against the mast. On the no.1 rig remove the sidestays from the spreaders.
Mast Detail
© Craig Smith 1997


Alternate pivot adjustment for the no.1 rig. I use a fabricated plastic slide and cut a slot in the boom to allow for the fore and aft movement.
Pivot method no.2&3 Rigs.
2mm bolt.
Make a slot.
Ball-race fishing swivel.
Make a hook from a fishing clip, or use 1.25mm S/S wire.
I run the leech line around the back of the slide then along a groove filed in the under side to a 2:1 adjustment forward on the boom somewhere.
O ring or cable tie
Forestay length measured to here.
Jib boom layout
© Craig Smith 1997

Rig no. →	1	2	3	Description
N	80	66	45	Pivot point
O	300	290	245	Holes for sheet adjustment hook
P	379	352	302	Jib sheet shackle
Q	382	355	305	End of boom from tack
R	28	To suit swivel	To suit swivel	Boom hight off deck



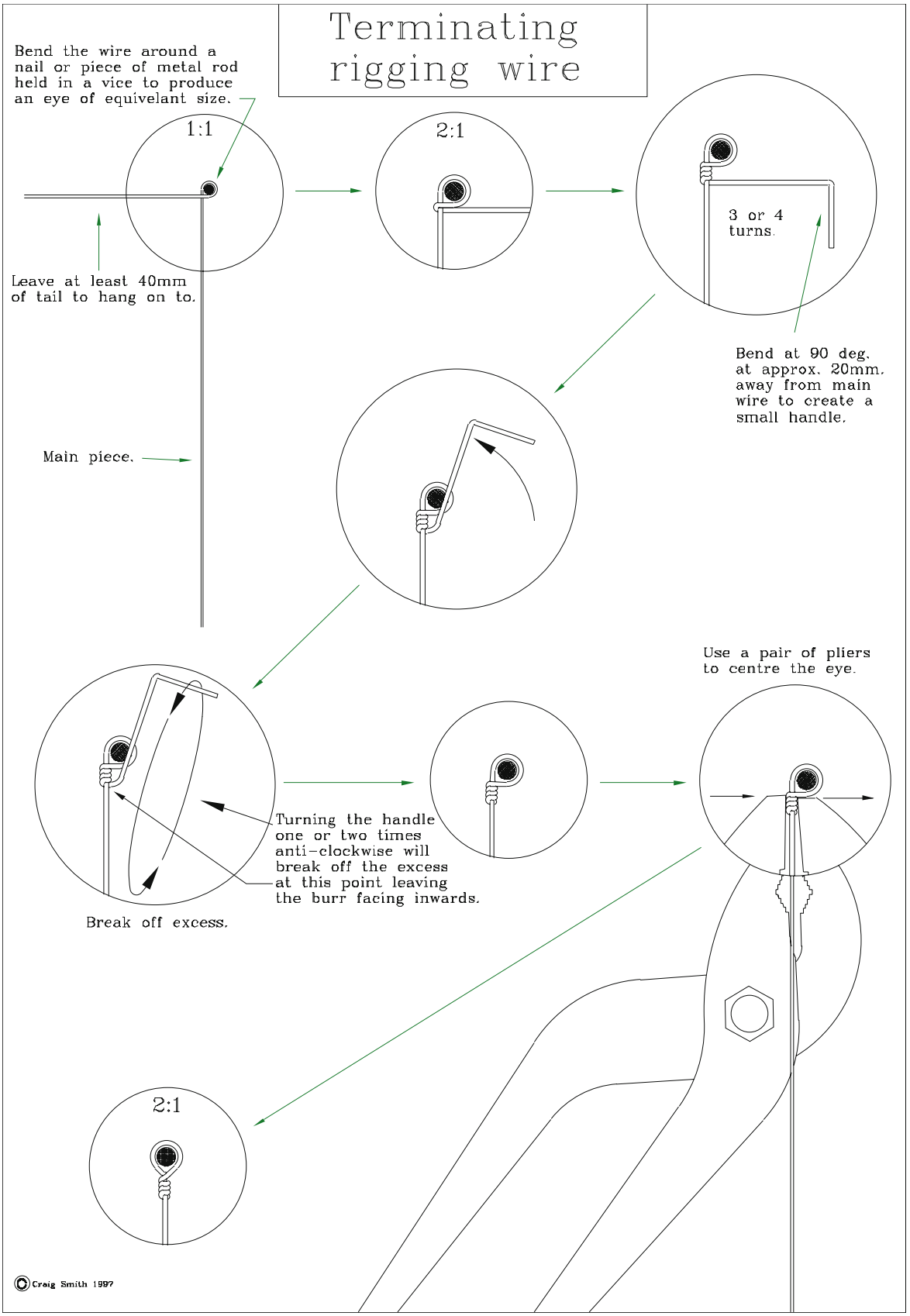
Jib boom



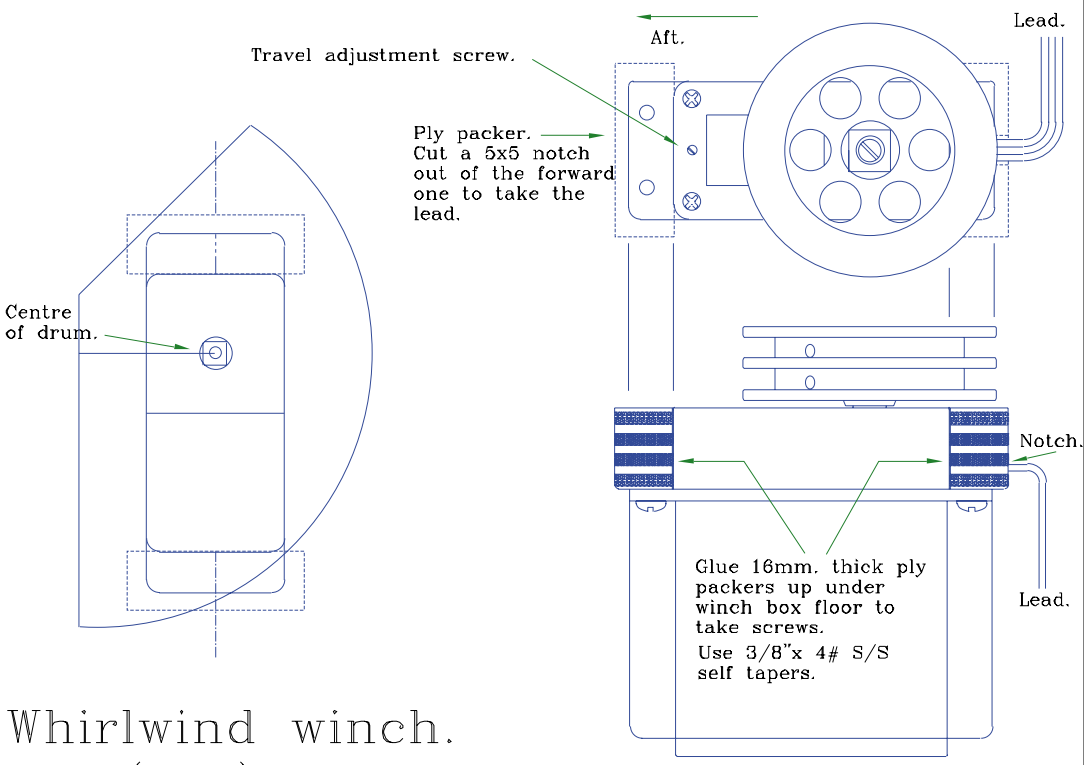
Note.

The forestay length is measured from the top bearing point of the wire to the top of the boom where the wire connects.

Rig no.	1	2	3
Forestay length.	1332	1010	750


Terminating rigging wire
Bend the wire around a nail or piece of metal rod held in a vice to produce an eye of equivelant size.
1:1
2:1
3 or 4 turns.
Leave at least 40mm of tail to hang on to.
Bend at 90 deg. at approx. 20mm. away from main wire to create a small handle.
Main piece.
Use a pair of pliers to centre the eye.
Turning the handle one or two times anti-clockwise will break off the excess at this point leaving the burr facing inwards.
Break off excess.
2:1
Craig Smith 1997

Whirlwind Winch Installation



Whirlwind winch.
(Atlas)