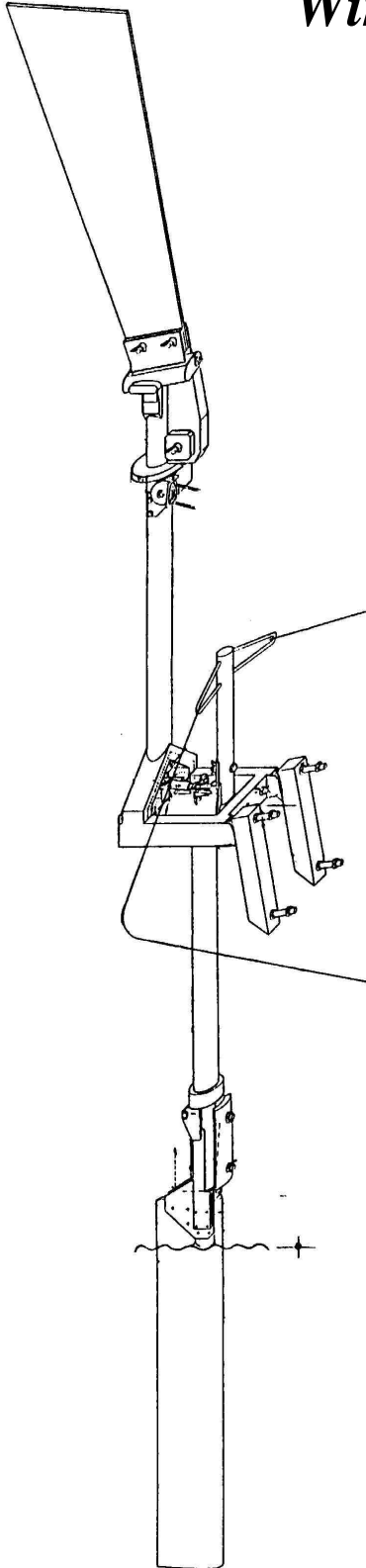


HOLLAND WINDVANE

Windvane Steering System

**** A Unique concept ****



HANDBOOK

**L
A
R
G
E**

MODEL

Hanco Poot
HOLLAND WINDVANE
www.hollandwindvane.com

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Handbook: edition 2007, Hanco Poot

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Request: It will be appreciated if you forward any remarks, hints, or comments regarding the assembly instructions for the vane.

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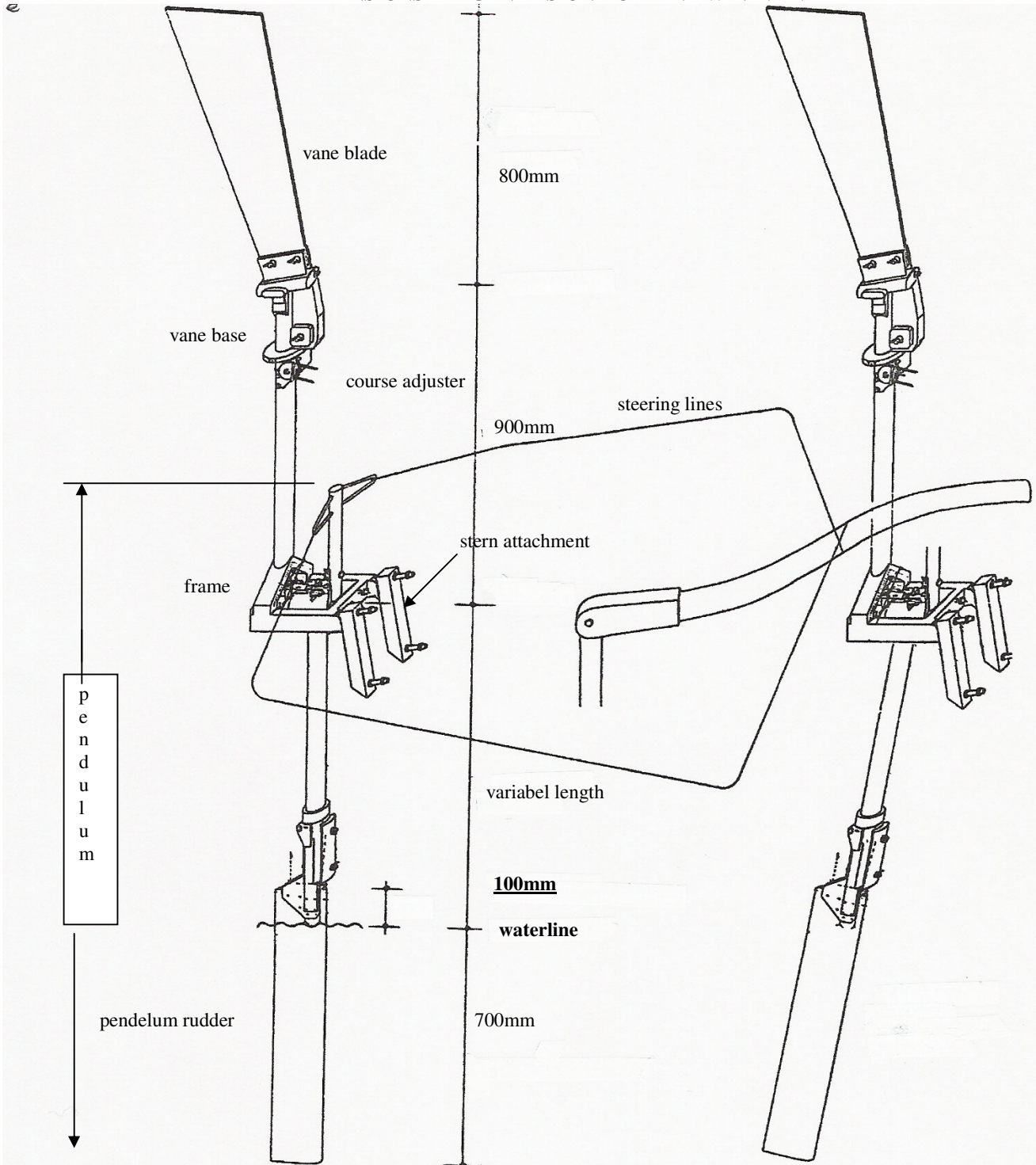
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DIMENSIONS LARGE VERSION HOLLAND WINDVANE



vertical pendulum

pendulum 10 degrees

1. THE CONCEPT

The HOLLAND WINDVANE is characterized by durability, solidity, and affordability.

The HOLLAND WINDVANE concept is unique and stands out through the following features:

- Specially designed for Do-It-Yourself: a full set of construction drawings and a comprehensive construction manual is included.
- Uses commercially available materials with standard measurements: changes and repairs are easy.
- Construction method designed for the Do-It-Yourselfer with standard tools.
- Constructed of Stainless Steel 316: strong and maintenance free.
- Use of ball bearings for minimum friction: the HOLLAND WINDVANE functions in very light winds.
- Tip-up pendulum rudder and a shock-absorbing frame: less chance of damage in case of collision.

These main properties make the BOUVAAN especially suitable for long distance sailing.

2. THE HANDBOOK

The manual can be used not only for the construction of the vane, but also for repairs and adjustments based on your own requirements or innovations.

The construction manual is written for the average Do-It-Yourselfer, therefore no use is made of true technical drawings.

It is strongly recommended that you follow the instructions and the test procedures as accurately as possible.

There are two sets of drawings, one for the full kit and one for repair.

The handbook contains templates for difficult drilling and cutting pipes. Steel jigs are part of the kit as well.

3. MATERIALS

General

The HOLLAND WINDVANE kit consists of about 250 parts, of which 75 stainless steel items are prefabricated sheet material and 35 are tube material. The prefabrication of the more complex pieces saves the DIYer a lot of time. All materials are selected for durability and are maintenance free. All stainless steel is 316/A4.

Bearings

The biggest enemy of a windvane steering system is friction. The bearings must have only a little friction, be durable, maintenance free, and salt water resistant. The HOLLAND WINDVANE is equipped with delrin ball bearings with hard glass balls. These bearings are trade standard articles. The ball bearings are easily made to fit in stainless steel tubes by filing the inside of the tube.

Note: The bearings have to be assembled by hand, but require a friction fit, both on the shaft and in the casing. Too tight a fit will cause the bearings to bind.

Wood

The windvane blade has to be light and is made of water resistant 3 layer plywood, for example – ockume. Paint or varnish is necessary to protect it from all kinds of weather,

The pendulum rudder can be made of hardwood or of water resistant hard plywood. This rudder blade has to be heavy. Hardwood is heavier than plywood but is more difficult to shape. If you choose hardwood use quarter-sawn wood. It is not necessary to paint hardwood. Multiplex or marine plywood is generally available and is much easier to shape than hardwood. By bevelling the plywood the different layers appear on both sides and provide an easy check of the symmetry of the desired profile shape. If using plywood, use certified marine plywood; this is stronger because it has no gaps and overlaps. Mahogany plywood is preferred over ockume because it is heavier, stronger, and harder. If the plywood is not available in the desired thickness, 2 sheets must be glued together. Use epoxy or water resistant PU glue (class D4). The finished plywood has to be protected with a coating – use epoxy or several coats of a good varnish.

Lead

The contra weights and balance weights are made of leaf-lead (used for gutters) which is available in rolls of various lengths and thicknesses. The desired shape can be easily obtained by making cuts in the surface of the lead followed by bending. The shape of lead parts can be obtained with the aid of the stainless steel cover plates. The assembling of leaf-lead needed with a thickness of 2 mm is 3000 mm² for the large BOUVAAN and 2000 mm² for the small one. A different thickness is compensated for by using a different area. You

need 60 cm³ of lead for the large vane, 40 cm³ for the small one. If leaf lead is not available, you can make a wooden mold, melt small quantities of lead (do not breathe the fumes) in a small pot, and pour the molten lead into the mold to create the required shape.

Pulleys, steering lines, and clamps

Use low friction pulleys to guide the steering lines.

Use lines of differing colours for the various functions. The lines must be stretch-free and hard wearing.

The clamps have to be easily accessible and the lines must not slip off the clamps accidentally. You can use “floating clamp” cleats (clam cleat type CL223), or fender cleats.

These materials are not included in the kit; they are easily obtainable and are dependent on the type of boat.

4. BUILDING PROCESS

Note: Take safety measures. Use safety glasses with every mechanical operation, use gloves.

Building the HOLLAND WINDVANE requires 50 – 100 hours of work, depending on your level of experience and the type and quality of equipment available to you. The main activities in constructing the HOLLAND WINDVANE are filing, drilling, and some welding. For difficult operations, jigs are supplied. For stainless steel, use HSS saws and drills and ensure that you remove all steel saw/file/drill dust to avoid future rust issues.

Welding

TIG is recommended. It is the only possible way to weld thin sheet material and to produce smooth tight joints. Approximately 4 hours of welding, including affixing and finishing, are required. Welding can take place all at once, but you lose sight of the flow of the construction process.

Staining

To make the welds rust free you have to stain them. This is done with a special paste containing strong acids; your welder can recommend it. Make sure you wear glasses and gloves for this activity and rinse everything well afterwards.

Polishing

When the HOLLAND WINDVANE is finished it has to be polished. First use Scotchbrite cloth (type red) followed by very fine grinding paper (grain > 800). This is much easier than actual polishing and gives very nearly the same result.

Items of Interest

- 1) Pipes with a thin wall deform easily during the manufacturing process. Don't use a vise when sawing, use a miter box and clamp the pipe with your hands.
- 2) Use a file or abrasive cloth to smooth every cut you have made.
- 3/ Sometimes a standard pipe has an inner weld. This has to be removed by hand with a file or an electric drill.
- 4) If you have to drill without a jig, make a centre punch mark to avoid having the bit run away.
- 5) It is possible that during the welding process the material will deform. This is undesirable, especially for those tubes that serve to accommodate bearings. To minimize this you can in-

sert a bar of the precise outer dimension into the inner tube. This helps to keep deformation to a minimum. Use special electrodes for RVS 316.

6) Use aluminum profile between the jaws of your vise to avoid rust contamination.

7) When assembling the bearings, push, do not hit, with the tube on the rings. Avoid pressure on the free outer ring and put no force on the inner ring or balls.

8) Drill stainless steel at low speed.

Required tools

- | | |
|--|-------------------------------------|
| -Workbench | -Steel bore drills 8, 6, 5, 4, 3 mm |
| -Vise, clamps | -All purpose drills 8, 2 mm |
| -Variable speed electric drill | -Pop riveter |
| -Metal hand saw with HSS blade | -Tap: M5 |
| -Files: ½ round/flat, round (reg. & small) | -Pliers |
| -Abrasive cloths P60, P800 | -Sink Cone |
| -Abrasive tool O.D. 25-30 mm P60
(for use in drill) | -Countersink bit |
| -Hammer | -Scotchbrite polishing cloth (red) |
| -Screwdrivers | -Set of box wrenches and spanners |
| | -Welding machine (Welder) |

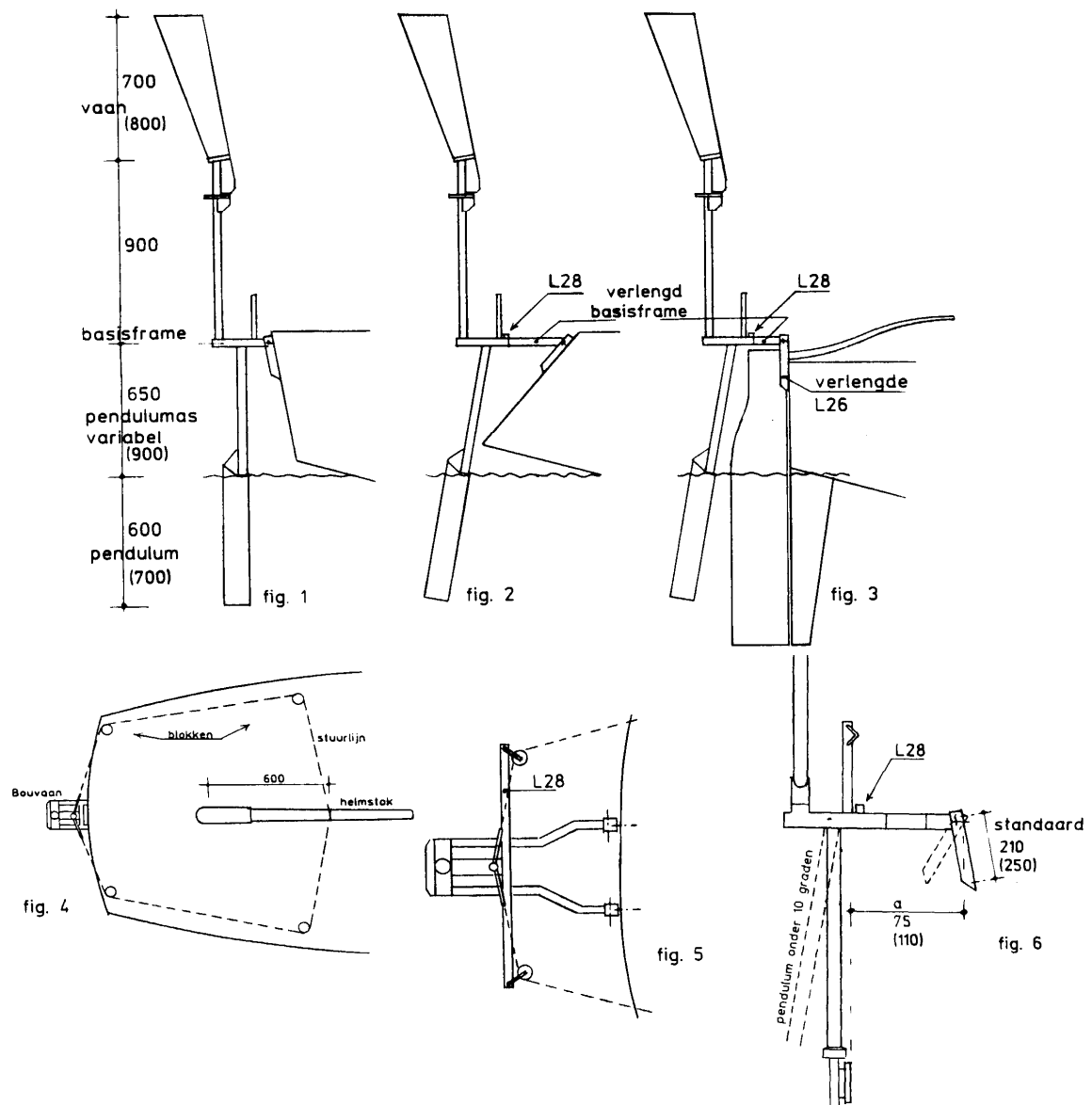
5. INSTALLING THE VANE TO THE BOAT

Determine the length of the HOLLAND WINDVANE

Drawing 1 shows the main dimensions which serve as a starting point for mounting on the stern. The reference point for the measurements is the pendulum rudder above the waterline.

NOTE: The upper part of the pendulum rudder has to be 100 mm above the water surface under loaded condition of the boat.

The frame is assembled as high as possible on the stern so that the windvane blade is in an undisturbed flow of the wind and the frame with the pendulum-link is within reach. The normal position is 5-10 cm under the upper rim of the stern.



NOTE: -Take care that when determining the position of the fastening supports (P153), there is also sufficient space for the fastening bolts, contra plates and washers (inside the hull at the stern).

-The HOLLAND WINDVANE is made to size for your ship by enlarging or shortening the pendulum shaft (P89, drawing 19 and P115, drawing 23) This measure of centre of the frame to water level is indicated on drawing 1 as “variable.”

Mounting to the boat

The principle of the mounting is given on drawings 31, 32 and 35. The vane is mounted against the stern with four bolts in P153 (drawing 31). Reinforcement of the stern is mostly not necessary because the forces on the stern are small. Whenever the stern has to be reinforced laminating a board of waterproof plywood on the inner side will do it.

10 Degrees angled Pendulum (figure 2)

With a negative stern or in the case that the clearance between rudder and pendulum gives a problem, it is better to construct the pendulum angled at 10 degrees rather than vertical. (Drawing 1 figure 2 and 3).

In this situation some parts have to be adjusted.

Elongated frame (figure 2 and 5)

When the frame has to be further from the stern (figure 2 and 3) an elongated frame is needed as indicated on drawing 33 and 35. The length of it depends on the distance from the HOLLAND WINDVANE to the stern. An elongated frame is always fitted out with an cross bar L28.

Cross bar

If it is not possible to place pulleys on the stern in the perpendicular plane (+/- 15 degrees) of the lever P90, an cross bar L28 is necessary to guide the steering lines in the proper direction.

Clearance between rudder and pendulum

It is advisable to maintain a space of at least 100 mm between the pendulum blade and the rudder so that the pendulum blade is not disturbed too much in the wash of the rudder.

Transom hung rudder

To avoid the vane jutting out too far behind the boat it is advisable to mount the frame high enough above the rudder that the rudder can turn underneath the frame. The supports P135 have to be enlarged. As an alternative one can fix a bracket around the rudder to mount the HOLLAND WINDVANE.

Fastening the steering lines to the helm (figure 4)

The steering lines have to run a little backwards of perpendicular to the helm. If a “stop knot/-pin” aft of the steering lines is used, the angle has to be large enough to hamper the sliding of the steering line from the helm.

Bathing platform

On boats with a swim platform or very strong negative stern a third vertical support for the HOLLAND WINDVANE is recommended. The frame might also be placed lower, whereby uncoupling of the pendulum blade may become more difficult.

On boats with a walk through transom or a swim platform a “swing frame” can be constructed, pivoting on one support of the frame.

Mounting in the centerline of the stern.

In principle a wind steering device has to be mounted in the middle of the stern. The pendulum rudder must remain in the water under all circumstances to generate sufficient steering power.

Depending on the behavior of the boat it might be necessary to mount the windvane somewhat off centre.

When the swimming ladder is mounted in the middle, it has to be moved to the side.

If the width of the swim ladder does not allow this, it is often possible to make it somewhat narrower.

NOTE: A good swim ladder is essential for safety

Retrofitting

If the height of the pendulum is not correct, you might apply the following corrections

-too short: mount frame lower, alternative make P89 and P115 longer.

-too long: mount frame higher or shorten pendulum tubes P89 and P115

-Too close to the stern: add hard wooden strips between the supports P153 and the stern

Remark: The windvane blade must have an undisturbed wind flow under all conditions.

Wheel steering

On a boat with a steering wheel, the steering lines will be connected with a pulley on the wheel. With a normal deflection of the rudder of 2×45 degrees and a revolution of the wheel of 2×270 degrees, the pulley has to have a diameter of about 170mm. To adjust the power/deflection, the steering lines wings (drawing 20) are adjustable in height.

-On a boat with hydraulic wheel steering the diameter of the pulley has to be adapted to the number of revolutions. It could also be possible to connect the steering lines with the emergency helm. For this it is often necessary to disconnect the pressure system with a valve in the pipe.

6. CONSTRUCTION MANUAL

6.1 Introductory remarks

Drawings

**Note: For kit construction the left page drawings are applicable.
The right pages are for self construction or repair.
When the left page is blank, there is no difference between the two construction methods.**

You can find the exact dimensions on the right hand pages. Many dimensions of sheet material are specifically chosen for does it yourself construction.

Welding

In the construction manual, the welding treatments are marked in the right margin as indicated here. If you choose to have the welding take place afterwards in one go, you can easily find the parts to weld by looking for this mark.

Pendulum angled aft at 10 degrees

With a 10 degrees pendulum, the deviating parts are clearly indicated on the drawings.

Numeration

There are three types of drawings. First are parts drawn one by one, secondly the welded parts and third the composition in functional units.

The numeration of the parts follows also this logic:

- P and H numbers indicate individual parts
 - Type P (production) has to be made
 - An * before the parts means prefabricated.
 - Type H is material you can buy in the shop (e.g. bolts, nuts, bearings)
- L notation refers to welded parts.
- M indicates assembled parts (composed by P, H, and L.)

The following notations have been used for tubes:

- Ø38x1,5 tube, exterior 38mm, wall thickness 1,5mm
- Ø8 rod with a diameter of 8mm
- k40x20x2 rectangular box tube, exterior 40 to 20mm, wall thickness 2 mm

Measurements

All measures are in mm, unless otherwise indicated.
The accuracy of the measures is 1mm, working more precisely is not necessary.
Dimensions that are not critical are indicated with “ca”.
The European “,” (comma) is used to indicate the decimal point in dimensions.

Templates and jigs

Most slant tube ends can easily be cut and drilled with the notches and holes on the drilling jigs *P161 and *P162 (see drawing 39).
The paper templates can be cut out and laid around the tube and fastened with tape. Cut the parts on the indicated lines (check the measures; copiers are not always precisely adjusted 1 to 1). The curved lines on the stretches match a straight saw cut.

List of materials

The appendix contains a parts list. This is a handy survey in which you can find:

- Drawing number of the part
- Numbers of a specific part
- Material of the part

Drawing 2, gives all data for the stainless steel bolts and nuts.

Note: Construct the vane following closely the instructions in the manual.

First read carefully each full paragraph to the next attention stroke in the margin, before starting to work.

BUILDING INSTRUCTIONS

6.2 Frame

Drawing 103 (see for missing data the drawings on the right hand.)

-Make P1.

If P1 has to be larger (elongated frame such as a negative stern or a transom hung rudder) see first drawings 35 and 33 and adjust the length of P1. With an elongated P1 it is not necessary to weld the folds immediately.

Remark: the holes in the upper part are for the cross bar L28 (drawing 34) if required.

-Make P3 and P7.

Put in with a centre punch the marks in the left-hand upper corner as indicated on P3, *P4 to *P6 and P7. These parts have to be assembled later in this order.

Drill the holes $\varnothing 8$ in P3 and P7 with the aid of *P4 as drilling jig.

Drill the draining holes $\varnothing 4$ in P3 and P7.

-Make P8, P9 and P11.

The bottom of P9 can be sawn with jig *P161 (drawing 38) or with paper template on drawing 36.

Note: Take care that the tubes do not deform when the jig is fixed.

P9 has to fit on *P14. File the cut.

-Slide tube P8 over tube P11.

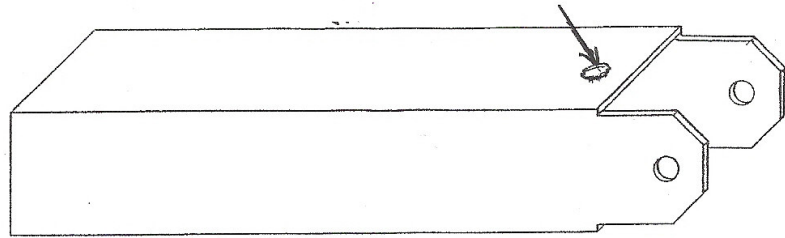
This may need some grinding.

Hint 1: Start to file the edges well fit and grind the surfaces of the tubes long and thoroughly. The reaming of the inner diameter of the tube can be simplified with a small circular device of abrasive cloth on an electric drill. If the fitting still gives difficulty you can roll the outside of the internal tube over a grinding machine. Be aware of contamination of rust particles from the disk. Clean the disk beforehand.

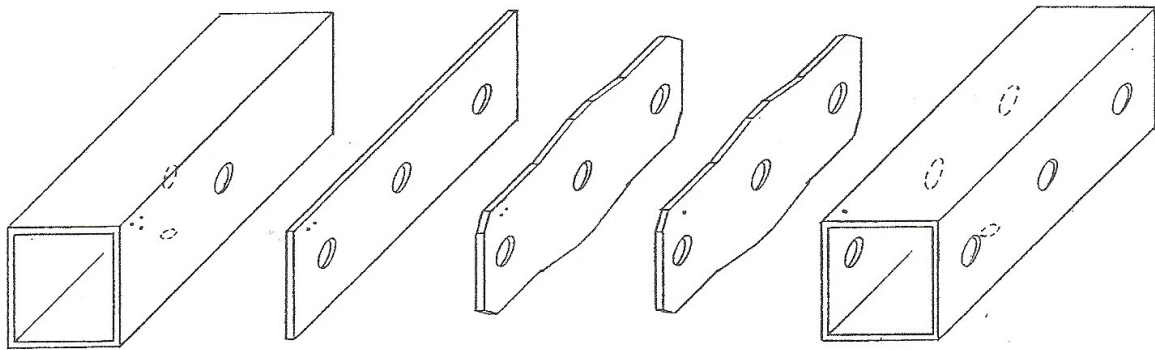
Hint 2: When you have the impression that the tubes nearly fit, you can force the tubes into each other, never hit directly on the end of the tube, use a piece of wood to protect the edge of the inner tube on which you are hammering.

drawing 103

($\varnothing 8$ for optional crossbeam L28, see draw. 34)



P1 2x



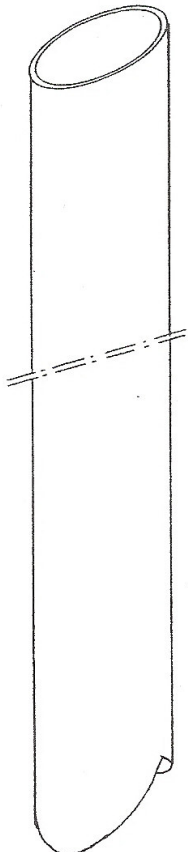
P3

*P4

*P5

*P6

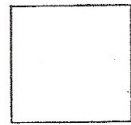
P7



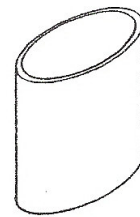
P9



P11



*P12 2x

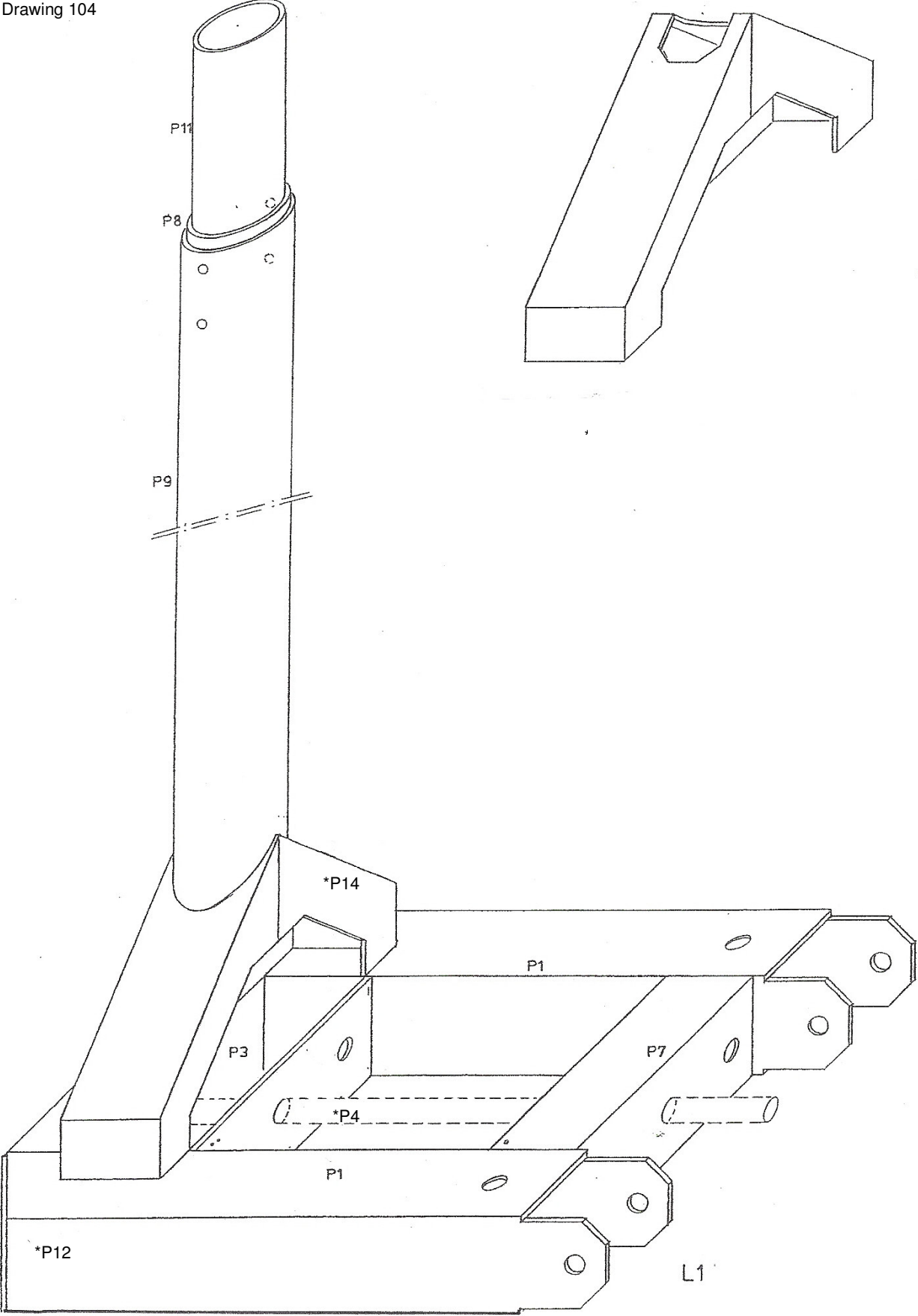


P8

Drawing 104

-Weld P8 at the bottom with one single weld spot to P11. P8 should fit very tightly into P9, since P8 must become fixed in P9, preferably without a weld, so that later on *P15 can turn well around P8. A weld spot where P8 fits into P9 would interfere with *P15's ability to turn.

Drawing 104



Drawing 12

-Make P47.

*Hint: Cut the plates 5 mm oversized at 50x50 mm. Measure the thickness of the lead and determine how many squares are needed. Draw a grid of squares on the lead. Make a deep cut over the lines. Bending the plate back and forth can separate the parts. Put the squares of lead between 2 pieces *P14, and take care that the lead protrudes on both sides. Fix the package vertically in the vise and drill a hole of $\varnothing 8$ in the middle. Fasten the package temporarily through this with a bolt H7 and a wing nut H10 and rasp the protruding lead away. It is handy to make also now the lead for M7 (drawing 14) and M13 (drawing 25).*

Remove the sharp edges of P46

Hint: Polish the sharp edges of P46 and clean the file with a steel brush.

-Make P50 and assemble M3.

Weld one of the wing nuts H10 to P50 (alternatively damage the thread) to prevent loosening one of the nuts.

-Make the windvane blade P51 from 6mm water resistant plywood, see also chapter 3.

Hint: drill first the holes $\varnothing 8$ in the inner side of the slits then carefully cut the slits with steel- or a fretsaw.

*The slits in P51 have to match the holes in *P36 and the bolts H30 have to slide through them.*

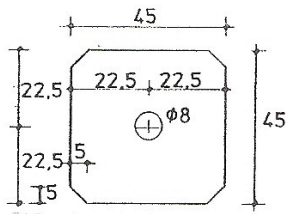
Paint the windvane blade.

Hint: Grind before painting the sharp edges to obtain a better result. Drill a small hole in the left top. When painted, hang the vane with a bit of string through this hole to dry.

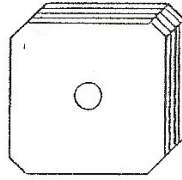
-Assemble M4.

Assemble P51 and *P46 with P47 and M3. When the whole assembly is laid down horizontally, vane and tailpiece have to be in equilibrium or the vane head may be a little heavier. Adjust this with the thickness of the lead P47 and the precise position of the counter weight.

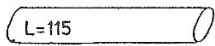
Note: Painting the vane increases its weight. The counterweight has to be adjusted to this. Every layer of paints equals approx. 5 mm of lead.



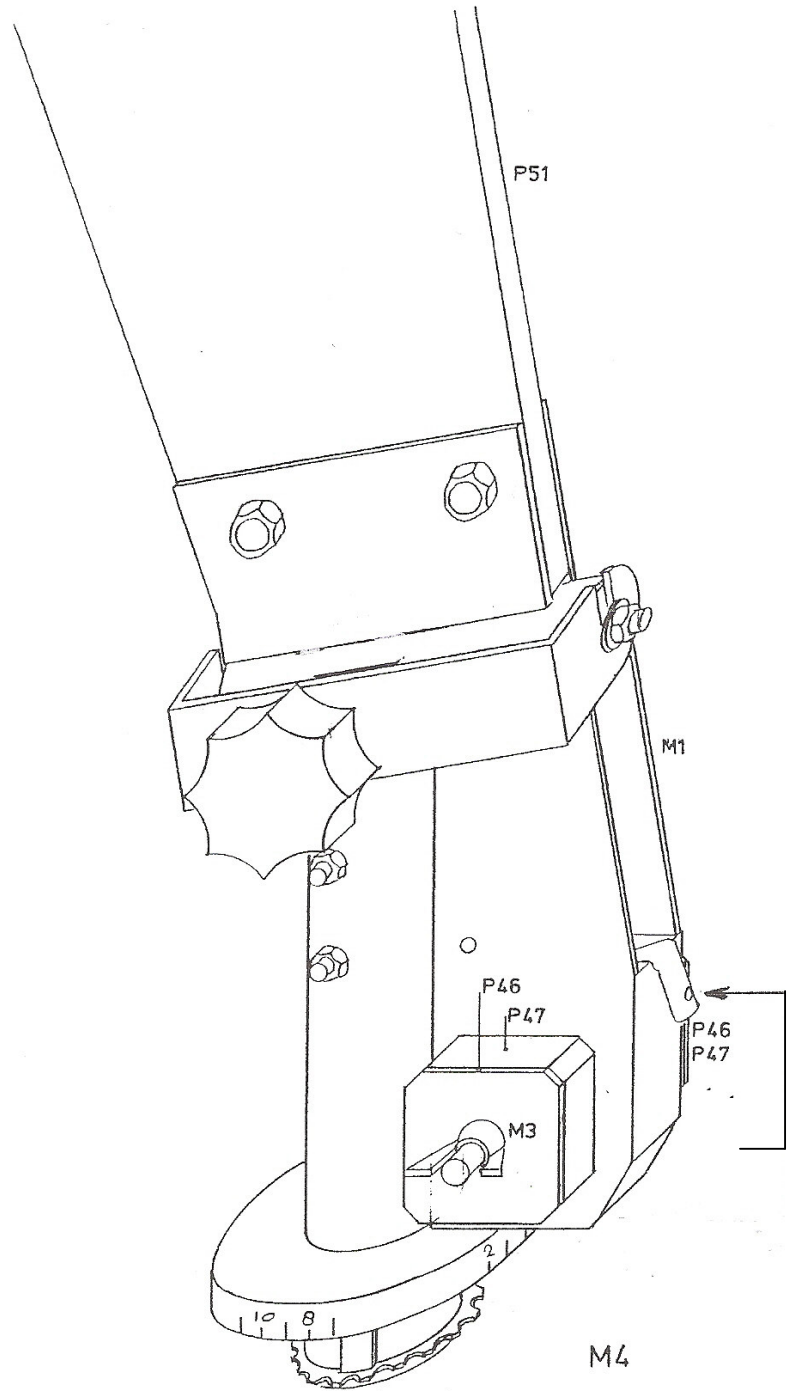
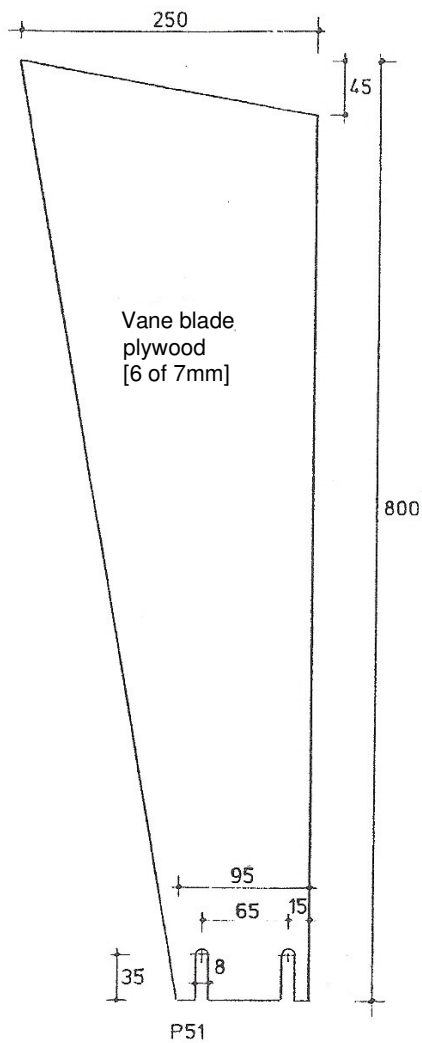
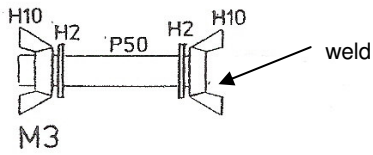
*P46 2x [1,5mm]



P47 2x (dimensions same as *P46)
slabs lead, thickness 25mm



P50 threaded rod $\varnothing 8$



Drawing 25 and 26

-Make P125:

Hint: Cut the lead 5mm larger. Clasp the pile of lead with 1 x P123 horizontally on the bench with a piece of wood under it. Drill the holes $\varnothing 8$. Assemble the second P123 on the other side with bolts and nuts H8. Fasten the whole in the vise and rasp the lead/file to measure. Take care not to damage the outer P123.

Assemble M13 on L17.

-Shape the wooden pendulum blade P126, (see chapter 3) with plane, rasp or file. As *P102/103 will be fastened on the upper part, the sides of this part have to be flat and not rounded. Take care that the middle of the upper part is not rounded off.

Check using the lines of the plywood which are exposed during shaping, that the profile is symmetric.

Hint: Align first the exposed plywood lines, the straight drawn lines on the four sides, the profile on the upper and bottom side and also the flat surface on the upper part.

If from the narrow upper corner a triangle is sawn, of approximately 20 x 60 mm, the blade can be stored in a folded position against P1. *These exact dimensions are dependent of the length of P89, it can be adjusted later.*

-Assemble M14.

Assemble M12 with P122, bolt H26 and nut H11 to L17. Take care that P122 and H26 can turn in *P117.

Assemble the pendulum blade P126 in M12 according to cross section A-A.

**Note: The position of the pivot of the pendulum blade is of utmost importance. Keep exact the measures in cross section A-A
Ensure that P126 is exactly vertical in L17.**

Drill the holes $\varnothing 4$ through P102/102 (of M12) through the wooden pendulum blade P126 and fasten P126 with bolt H16 and nuts H9. Cut the bolts H16 to length. Assemble the balance weight M13 with nuts H7.

Note: It is possible that you will have to increase the thickness of the lead P125 during the testing procedures.

Slide *P124 (drawing 123) on *P121.

Small BOUVAAN

Mount ball bearings H47 and H46 on L17. If necessary you can file the delrin bearing at measure. Mount ring H3 and split pin H40.

Large BOUVAAN

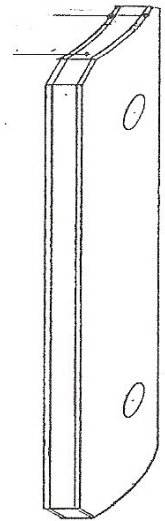
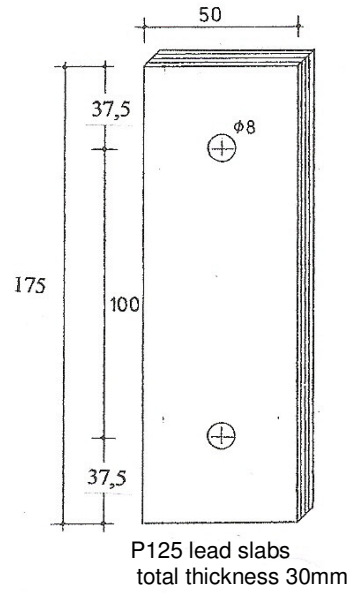
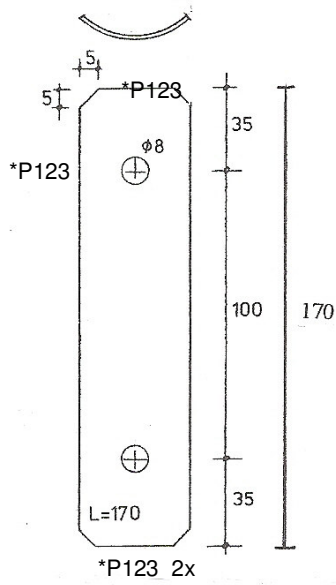
Mount ball bearings H47 and H46 on L17. If necessary you can file the delrin bearing to fit. Mount ring H3 and hose clamp H70.

-Assemble the line, (ca Ø5), H51 (A) on the upper side of P108. With this line the pendulum blade is disconnected by hand. The line has to be knotted to the stern-rail, so take sufficient length.

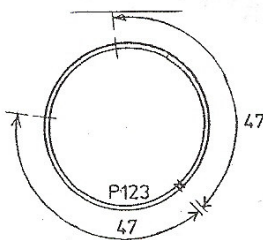
Assemble line H51 B-C, both ends knotted to bolt H16 from M12. The end B goes straight up, end C goes first through P119, passing behind M13 and then up.

With this line the pendulum blade will be drawn up and fastened in a vertical position. This line is also guided to the stern rail, so take ample length.

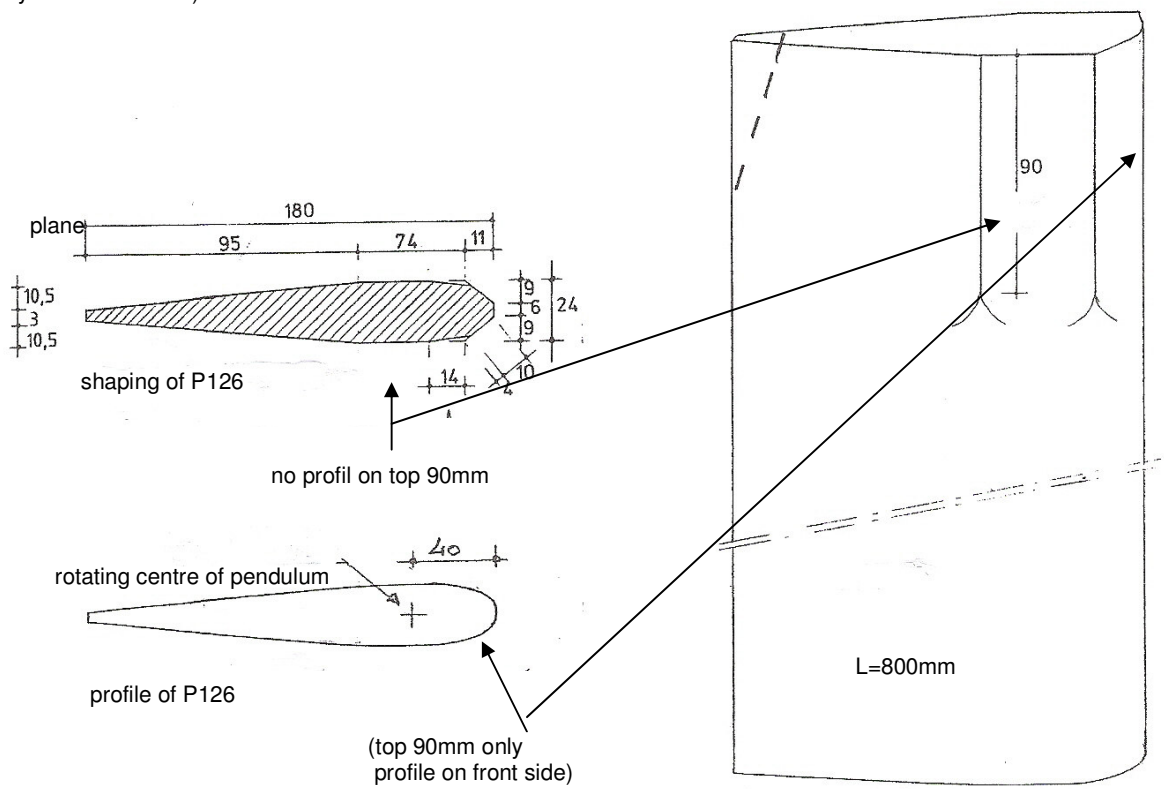
<p>Note: Use a wear-resistant line for C because of the friction in P119. If by frequent use the wear is too heavy; replace the lower part (50 cm) by a thin stainless steel cable.</p>
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M13



P123 2x sawed out of pipe $\varnothing 38 \times 1,5$
(only selfconstruction)



P129 wooden pendulum

ANNEX II HOW DOES A WINDVANE STEERING SYSTEM WORK

Basic principle:

The functioning can be described as follows:

The wind tilts the windvane blade,

=> the pendulum blade rotates a little,

=> the pendulum blade swings out and generates power,

=> the power is transferred to the rudder.

In detail:

1) The wind tilts the wind vane blade.

=> 2) The inner tube of the vane base moves up and down (drawing 16: M6).

=> 3) This movement is transferred to a rotation (drawing 16: rotation point P65).

=> 4) The rotation is transferred by means of coupling L23/L20 (drawing 31) on the pendulum shaft (drawing 28: M14). See top view A.

=> 5) As the pendulum blade is no longer in the sailing direction, it moves sideward by the power of the water. The steering lever above the frame with the steering wings moves in the opposite direction.

=>6) The power of this movement is transferred to the helm or steering wheels by the steering lines.

=> 7) The boat corrects course until the vane blade (and the pendulum) is in the vertical position again.

