PELICAN

STUDY PLANS

by Bernd Kohler

K-designs, Bernd Kohler
7 Rue de la Serre
11330 Maisons, France
phone: + 33 468450803

Dear Customer

Thank you for your interest on our Pelican design. This study plans will guide you to understand the design and will show you how much work is involved.
Many persons are afraid to build a boat from plans. When you know how to repair a chair you can build this boat. The ply wood/glass/epoxy system is a perfect system for first time boat builders. Depending on the construction system, building your own boat is easier as rebuilding an old boat. Of course the PELICAN is a big boat and it will take about 2000 hours of construction time.

PELICAN No. 12

ACCOMMODATION

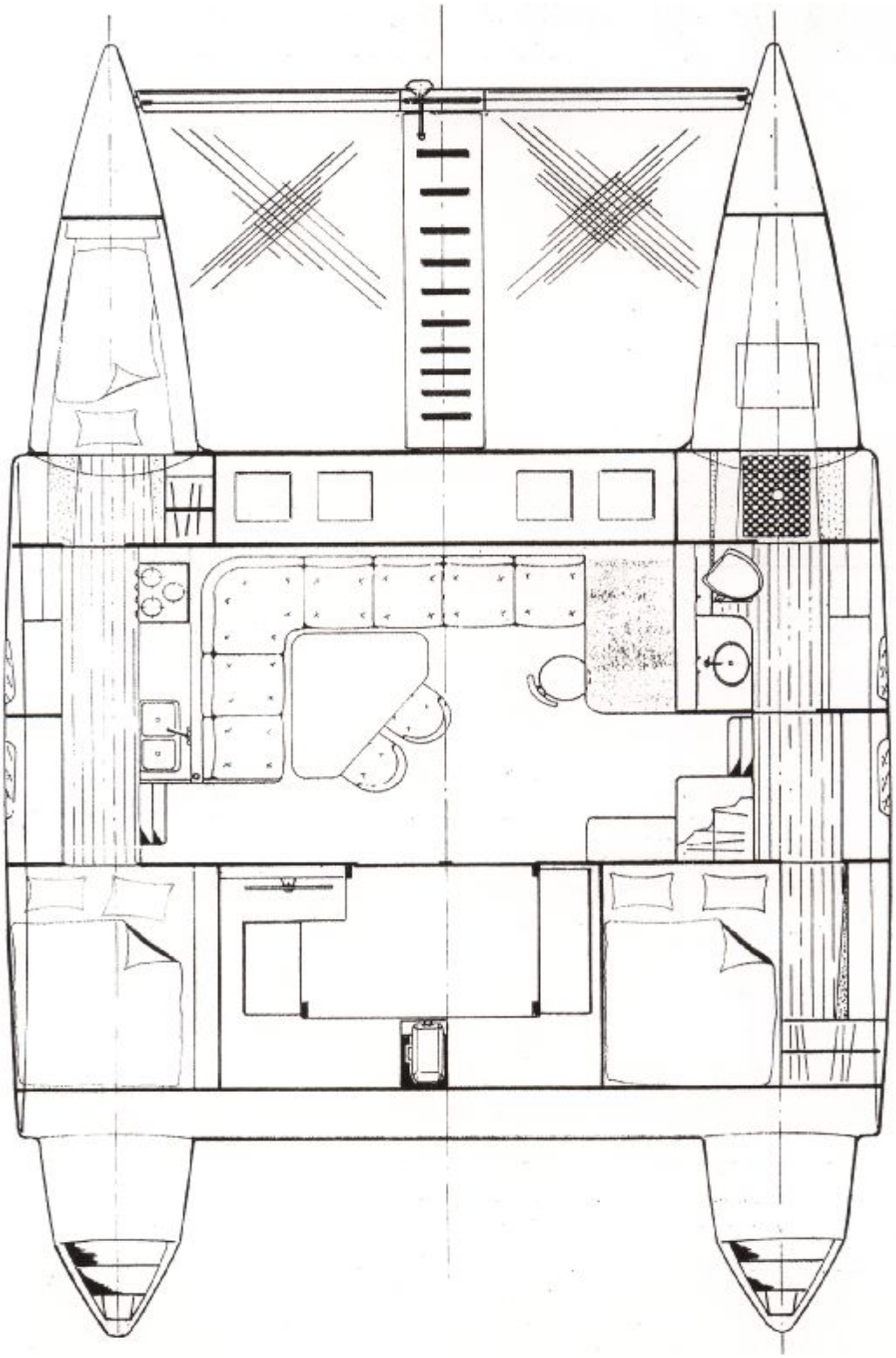
The accommodation shown is very comfortable and roomy, with two double cabins and one single cabin. The -big galley incorporates a domestic double sink and a gas cooker with s burners and oven. There are plenty of lockers and shelves for kitchen belongings. The bathroom has a separate shower. The hull compartment have a standing height between 2.2 and 2 m, whit still enough room for water tanks and storage below the floor. The bridge deck salon height is 1.72 m. The salon gives anyway big boat feeling through the open galley and split roof for the bathroom. Besides I prefer good sailing quality and esthetics to standing height, anyway in a room where you sit for 90 % of the time.

part of the saloon

The very roomy pantry

DESCRIPTION

Every effort was made to make the boat seaworthy (safe), comfortable (sea motion) and fast. The priorities are also in this order.
The hulls have a trapezoid cross section , like round bilge hulls from the bows till the anti-vortex panels, flat from there till the transom. The length to beam ratio is 1 : 16. This makes for a fast boat, which go's very well to windward (like a good mono hull of the same size). The anti-vortex panels work on a trapezoid hull better as keels or boards, without there draw backs. Low aspect ratio keels don't work properly anyway and add draft, boards add complexity to a boat, costing inside room and are prone to damage. Anti - vortex panels are also the easiest and cheapest to build.
The bridge begins 3.75 m from the bow, bridge deck clearance is 0.68 m. It is known that all catamarans where the bridge deck starts to far forward slam when going to windward already in small waves. Enough is already said on bridge deck clearance.

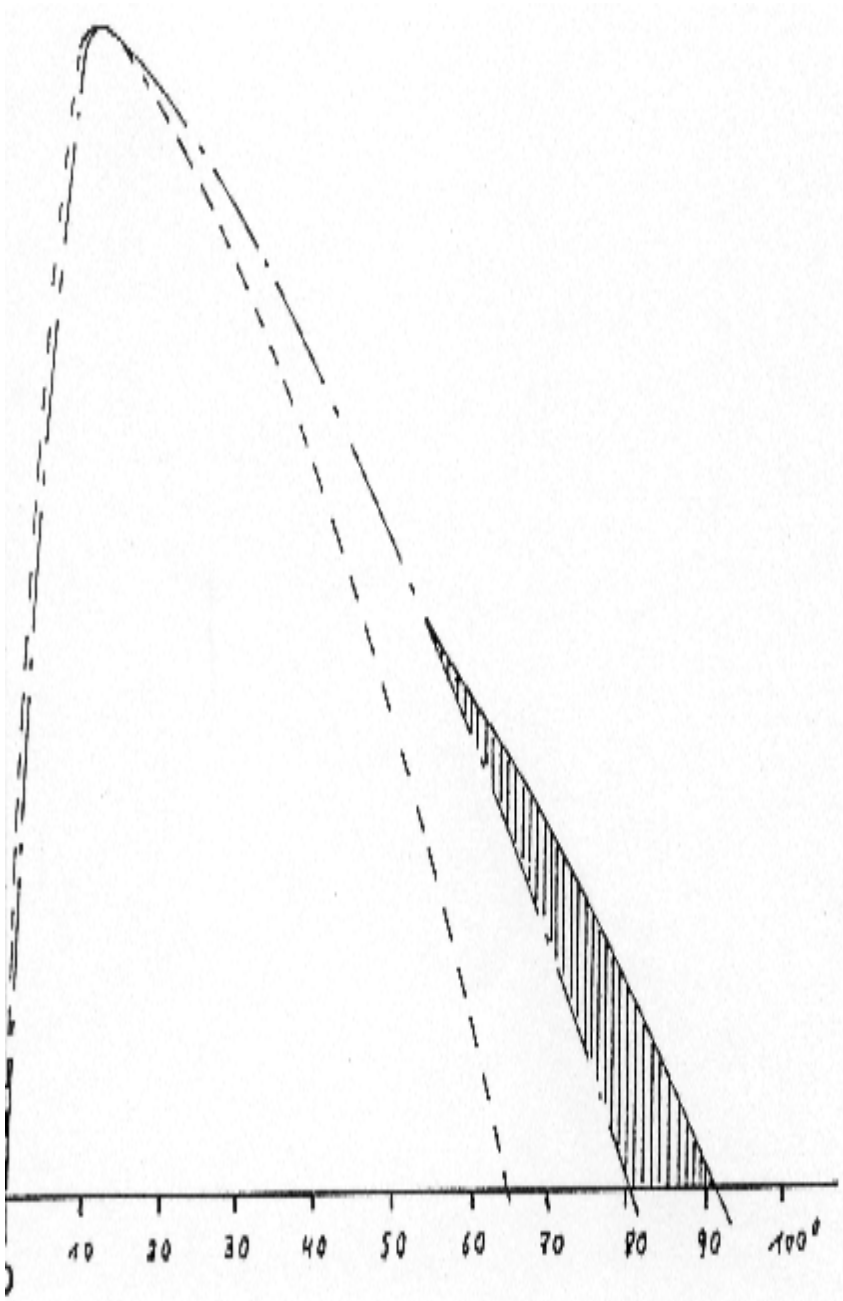


Pelican layout

The length to beam ratio (center to center hulls) is 1 : 2. In combination with the moderate sail area of

60 m2 and the low center of pressure of the sails the boat is dynamically stable till a wind speed of 35.7 kn (calculated wind fluctuation 90 % +). The praxis shows till the movement of the boat gets to uncomfortable a lot earlier depending on the wind direction we shorten sail at a wind speed of about 25 kn. The boat is doing then to windward about 10 kn and with a beam wind 14 kn.
In a real bad situation the boat has a lot for self defense. The flared hulls will slip side wise when a gust or wave hits the boat. The hull shape generates also dynamic lift on the lee side. Through the fast increase of volume when the leeward hull is pushed down the degrease of the righting moment is slower as with a hull without flare. The overhanging superstructure contributes to the righting moment from 52 degree onwards. In fact the boat is self righting till 93 degree (see diagram).

Anti vortex panel



RM = righting moment

--- conventional cat with U-cross section and almost vertical hullsides

-.-.- trapecoid cross section (Pelican hull shape)

▥ extra righting moment through overhang

Besides all of this the boat is fun to sail, pleasant to look at has very low maintenance and was easy to build. The only think I would change is from one to two engines for easier handling in every more crowded harbors.

Shower looking to the rest of the bathroom

SPECIFICATION

L.o.a.:	11.50	m
L.w.l.:	11.30	m
Beam :	6.85	m
Beam c/c :	5.20	m

Draft :	0.64	m
Mainsail	32.00	m2
Jib	20.00	m2
Reacher	60.00	m2
Weight empty	2200.00	kg
Weight load c.w.l.	4200.00	kg
Aux.power	22.00	HP
L/B hulls	1 : 16	
B/L ratio c/c	46 %	
Stability maximum	22000	kg/m

CONSTRUCTION AND COSTS

The boat is to be build in the wood/epoxy system. Experience shows, that this is still the best and most cost efficient way to build a one off catamaran of this size. For example, to build the boat as light as specified will be impossible with polyester, so expensive composite materials have to be used. The cost comparison will be then in favor of wood epoxy by a factor of about 1 : 7. When it comes to construction time, the plywood epoxy system is still the fastest way to build a one off boat.

GENERAL

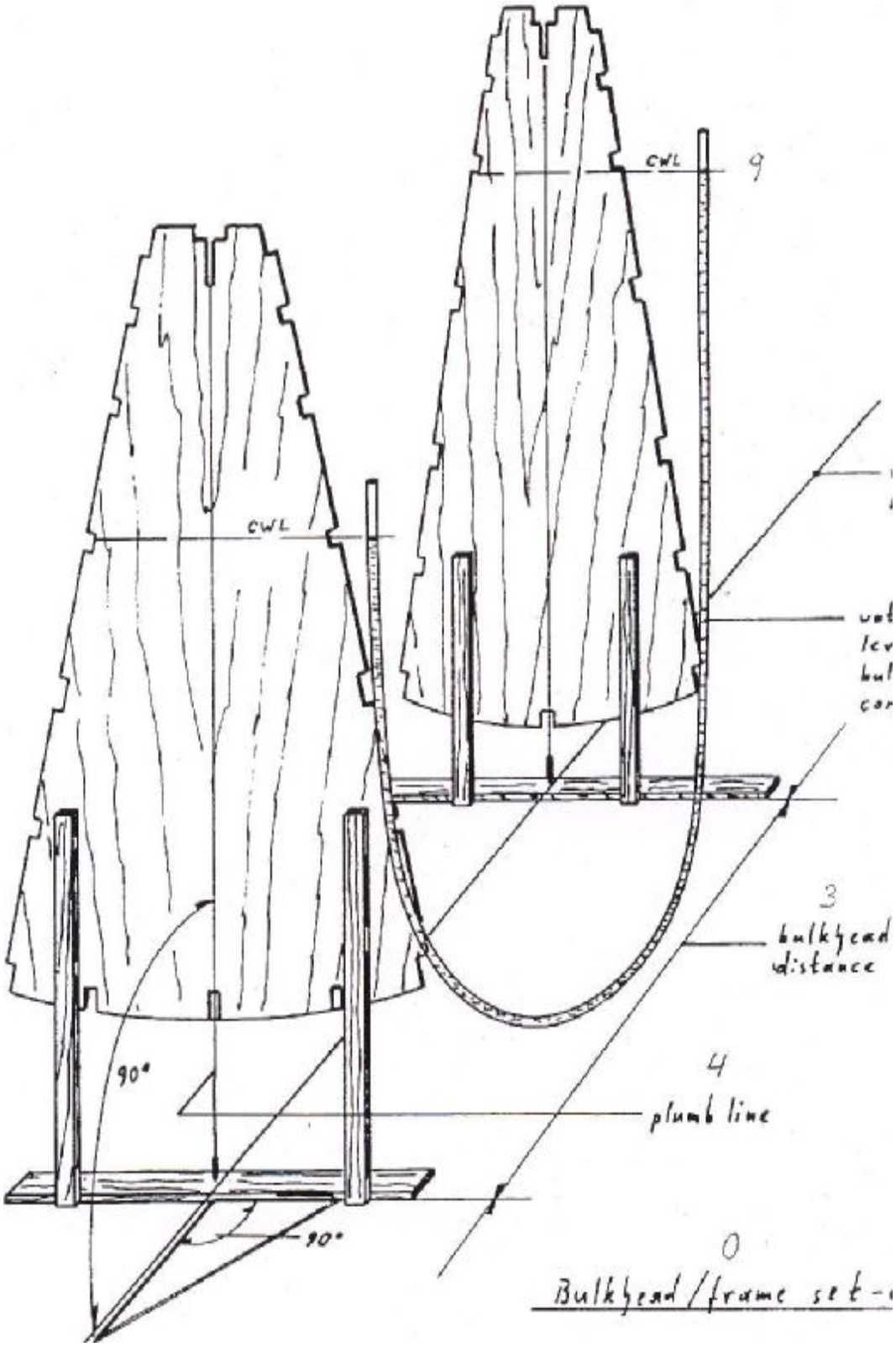
The layout shows the interior of the boat . The boat is very comfortable for 5 persons for long voyages. There is ample standing height in the hulls (1.85 to 2 m). The height on the bridge deck is 1.71 m. Please no alteration of the interiour. Parts of it functions as structure.
Example: The benches in the saloon are part of the mast bulkhead.
Figure 1 shows the boat with the standard rig. The wishbone gaff rig is an option. We found this rig preferable, because it is easy to handle and the boat is faster.
To build the boat as light as shown in the technical data you have to build correctly to plan and material specifications.
Whit the list of materials profited, you can calculate the costs of the boat.
The plans are now a mixed affair. The hull scantling are computer generated, the rest of drawings are manually made (see examples).
The "Table of contents" and the "List of illustrations" shows what you get on information to build the boat. The drawings on this information are original plans drawings.

CONSTRUCTION

The hulls are self aligning constructions. First all the bulkheads are built. The dimensions are given for each bulkhead/frame. Nine bulkheads have to be build. After this the backbone is build. This piece is very important, because it is the control of the under water shape.

Backbone

Then the bulkheads are set up level in all directions (see figure 27). Then the backbone and stringers are glued to all bulkheads.



Now you see already the shape of the hulls.
The best thing is to build both hulls parallel in one go. In this way you will be sure to end up whit equal hulls.

The hulls now ready for planking. I recommend to impregnate the paneling plywood whit epoxy before you fit the panels. You can impregnate and sand them flat on the floor. This is a boring job but will safe you days of sanding off tears and runners from the epoxy when it has to be done on an almost vertical surface. The hulls sides are covered with 9 mm plywood sheets. The bottom with 3 x 9 mm plywood. All panel connections are made with butt straps.

Now the underwater chine is rounded off till 3.2 m from the bow (fig. 9). So the boat will be round bottomed where it counts , the rest of the hulls have to have sharp chine corners for best speed
and windward ability.
By the way, we use anti vortex panes on the inside of the hulls for windward performance instead of boards or keels. These work like winglets on aircraft wings. The PELICAN sails as high on the wind as any comparable mono hull. Other advantages, no keels, low draft, not prone to damage like dagger boards or center boards, no inside obstruction like with boards, less construction time, low weight. Don't ask me to design them for a U-shape hull, because the work only on hulls with an chine !
Lets go on with the construction. After all screws are removed fill all screw holes, dents and nicks with epoxy filler. Then cover the hulls with glass fabric. Paint the hulls also with the under water pain. To build the hulls so far will take about 700 hours. The hulls are now ready to turn right side up.

Hull ready for turning

Because the hulls are light we turned the hulls with 5 persons and two rope slings fastened to the roof of the building.
Pace the hulls on two heavy wood pieces (about 6.5 m long, by 30 x 3 cm) which are covered with heavy plastic sheets. The wood pieces have to be placed about 7 m apart from each other and standing horizontally level (see figure 32). The hulls slide easy over the plastic sheets. Leveling out the hulls is then an easy job.
Now the three bases of the cross beams have to be build (see example figure CSp 4 sheet 1). The base is always made from 9 mm plywood and is build flat on the floor. By the way the roach curvature is on a separate sheet. The numbers on the wood corresponds to the material shown in the list of materials. Three "crossbeam" bases have to be build (mast beam, cockpit beam and aft beam). The are later part of the whole semi monocoque construction of the boat. But in this way the cross beams are easy to handle by two persons.
Now the hulls are lined out as shown in figure 32 and the mast beam is glued to the corresponded bulkheads, then the cockpit beam and at last the aft beam.
Next the bridge deck stringers are build and mounted to the beams. After this the cockpit and salon sole is covered with 2 layers of 9 mm plywood. The lower layer of plywood can be covered with glass fabric before these are glued to the boat (this is the under side of the bridge deck). In this way you don't have to work. with glass fiber and epoxy above your head (which always a sticky unpleasant job). The panel connections can be later covered with glass fiber tape. Wow, now it looks big and you can walk from one hull to the other, a great feeling. Besides for torsion the whole boat is now already rigid.
Now the mast beam has to be finished. Forward round parts with hatches (ref. figure 2), then the rounded aft beam. The covering is done with 2 layers of 4 mm birch plywood. This plywood is easy to bend.
The cabin sides are covered with two layers of 4 mm plywood.

Mast area

Before the roofs and decks are installed it is wise to finish the boat on the inside. Meaning, finishing the benches, chart table, kitchen, bathroom, sleeping quarters, tanks, wiring, engine installation etc. Part of this like berths and the salon bench is already there because it is part of the boats structure, but still this is very time consuming.
After the inside is finished (including painting), install the plywood decks and then the salon deck. These is made from western red cedar pieces. First a former is placed in the salon (highest part of the roof) and then the roof is covered. Start at the center by bending the cedar strip over the former piece and glue and screw them to the mast and cockpit beam. Work alternately from here towards the out-sides. Blind nail and glue the strips together. Cover the whole uncovered part of the boat with glass fabric. The salon roof has
to be covered with 3 layers of glass fabric. Then remove the former in the salon. Paint the boat to your liking. Install the rudders, fore beam, side windows, hatches, door etc. and the boat is ready for the water. Stepping the mast and installing winches, tracks etc. can be best done on the water.
This was building a PELICAN in a nutshell. Of course not every aspect was covered in this short description. But it gives you a good idea what is involved to built a plywood epoxy multi hull.
I hope you found already some good tips in this description how to save time. In the construction manual more useful information how to save time and money. There is for instance a description how to make a measuring device for epoxy - hardener which costs only pennies, but is very accurate (+/- 2 %) fast to work with and it is almost impossible to make a measuring error. There are also recipes how to make epoxy fillers and glue etc.

TECHNICAL DATA	
L.o.a.	11.50m
L.w.l.	11.30m
Beam c/c	5.20m
Beam	6.$5m
Draft	0.65m
Draft rudder	0.75m
Weight empty	2200 kg
Weight load c.w.l.	4600 kg
Sail area	
Main	38.00 m2
Jib	17.60 m2
Reacher	60 m2
Aux. power	22 hp
L/B hull	1 : 16
B,/I, ratio c/c	46%
Stability max.	22000 kg/m
Construction material	

General : Wood/glass/epoxy composite

LIST OF MATERIALS PELICAN

MATERIAL	DIMENSIONS	. QUANTITY .	
Plywood			
Ocumee 9mm	2,44x1,22	90	Bulkheads, out side
			panels, bridgedeck
			beams
Ocumee 6mn	2,44x1,22	50	secondary structure
Ocumee 4mm	2,44x1,22	20/40	furniture, paneling;
Birch 4mm	2,44x1,22	20	aftbeam , mast beam
			bent parts
Mahogany 6mm	2,44x1,22	4/8	rudder, dagger boards
Mahogany 12mm	2,44x1,22 -	0/2	daggerb.-case;
Lumber			
Western red			
cedar	45x20mm	520m	roof
Douglas fir	25x25mm	250m	1 s s
			u t
Douglas fir	25x40mm	450m	2 p r
			e u
Douglas fir	25x60mm	300m	3 r c
			u
Douglas fir	25x100mm	80m	4 r
Douglas fir	25x80mm	20m	outside stringers
			bridge
Douglas fir	25x45mm	20m	
Fir selected	18x18mm	200m	5 stiffeners sec.
			structure
Mahogany	25x50mm	20m	outside deck stringer
Mahogany	100x110mm	4m	outside stem
Mahogany	30x30mm	5m	rudder
Mahogany	20x30mm	5m	rudder
Epoxy +			
hardener		250kg	
Aerosil		25kg	

Glass spheres		20kg	

Glass fabric	280gr/m2	140m2	outside sheet
			rudders
UD-glass	450gr/m2	30m	super structure
UD-glass	600gr/m2	10m	superstr. ruddersys.

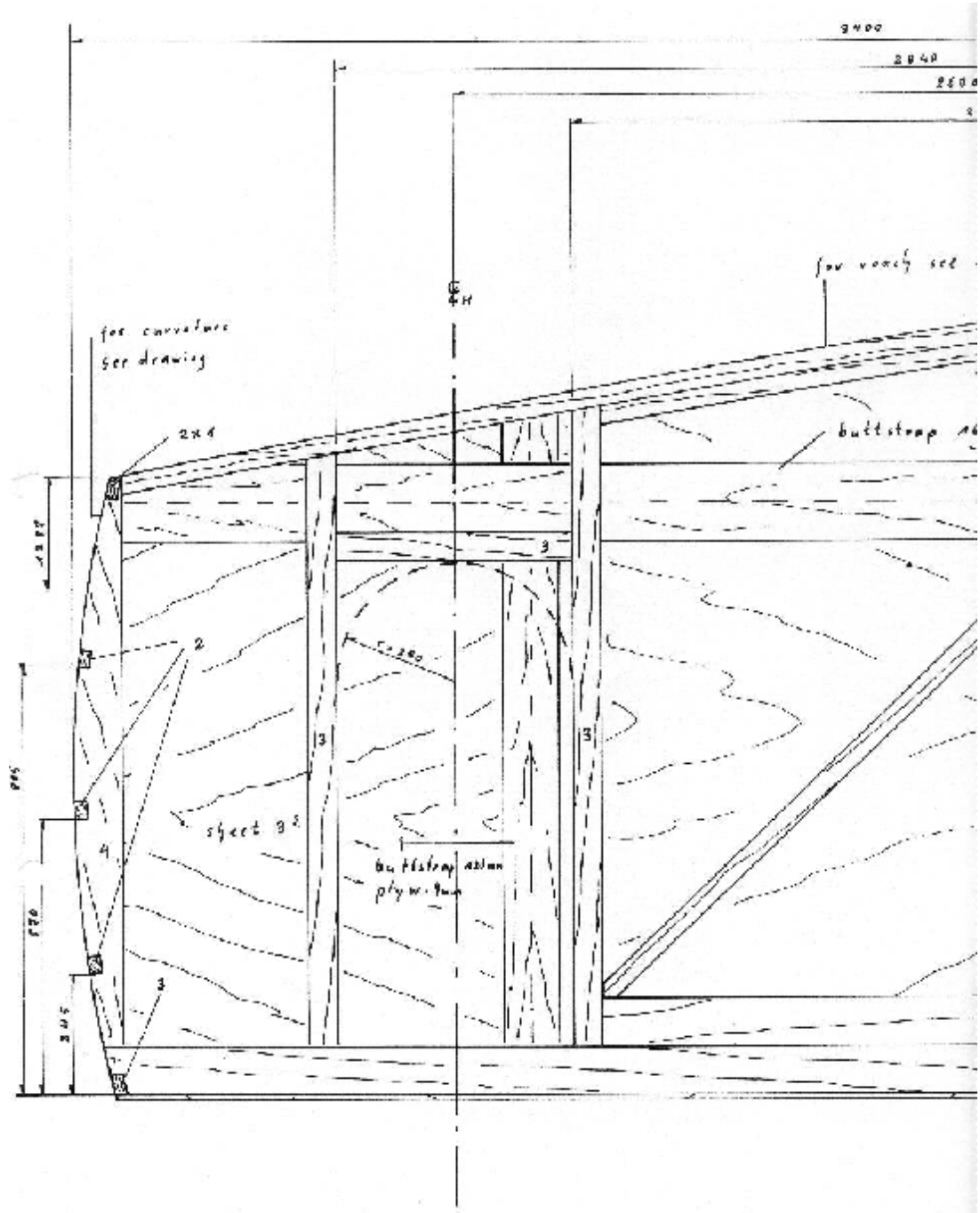
DD- paint Lexan 8mm	2x3m	11 - 1	door, windows
Fasteners			
Particle board			
screws	2,5x25mm	1000	used instead of
			clamps. Regular
	3,5x45mm	500	steel screws will
			be sufficient. The
	4,5x60mm	250	screws are removed
			after curing of the
	5 x100mm	100	epoxy glue
Al. mast profile	183x136mm	5m	forebeam
A1. bar	30x120mm	2m	forebeam
Al. tube	50/45mm	5,2m	rudder link
Al. tube	60/55mm	2,Om	water inlet
S.S.-steel			
Tube	30/26mm	1,6m	sliding rudder shaft
			rudder bearing
Tube	25/20mm	2,1m	rudder shaft
Bar diam.	20mm	0,2m	forebeam shaft (2)
Flat bar	10x80mm	0,3m	forebeam shank (2)
Flat bar	10x100mm	0,3m	putting (2)
Rigging			see rigging drawing
Sails			see sail drawing

TABLE OF CONTENTS

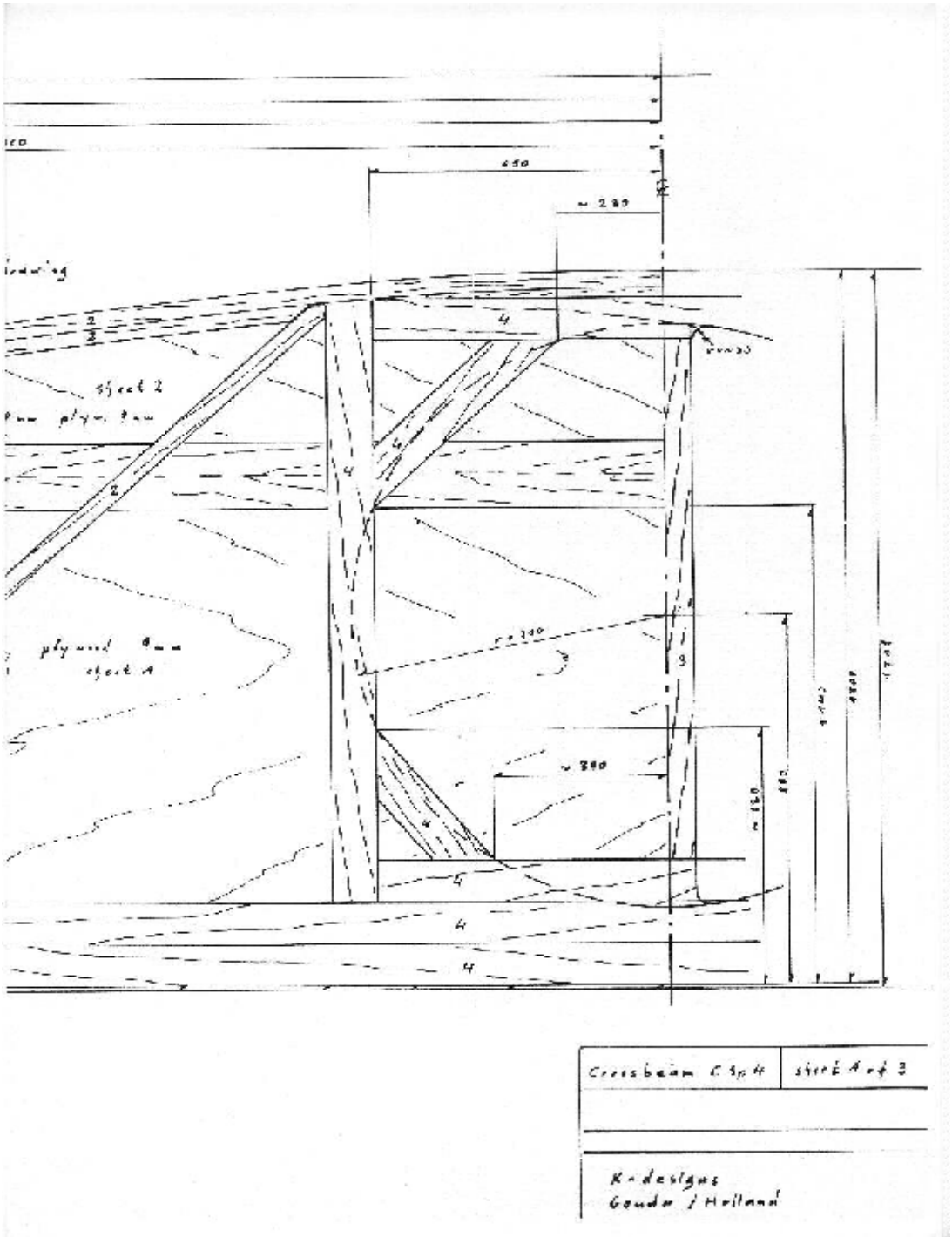
LIST OF ILLUSRATIONS

29	Keel/chine shape
30	Fillet
31	Bridgedeck stringer alignment
32	Hull alignment
33	Lower part, mast beam planking
34	Bridge sole planking layout
35	Forebeam construction
36	Fork forebeam
37	Sail and rigging

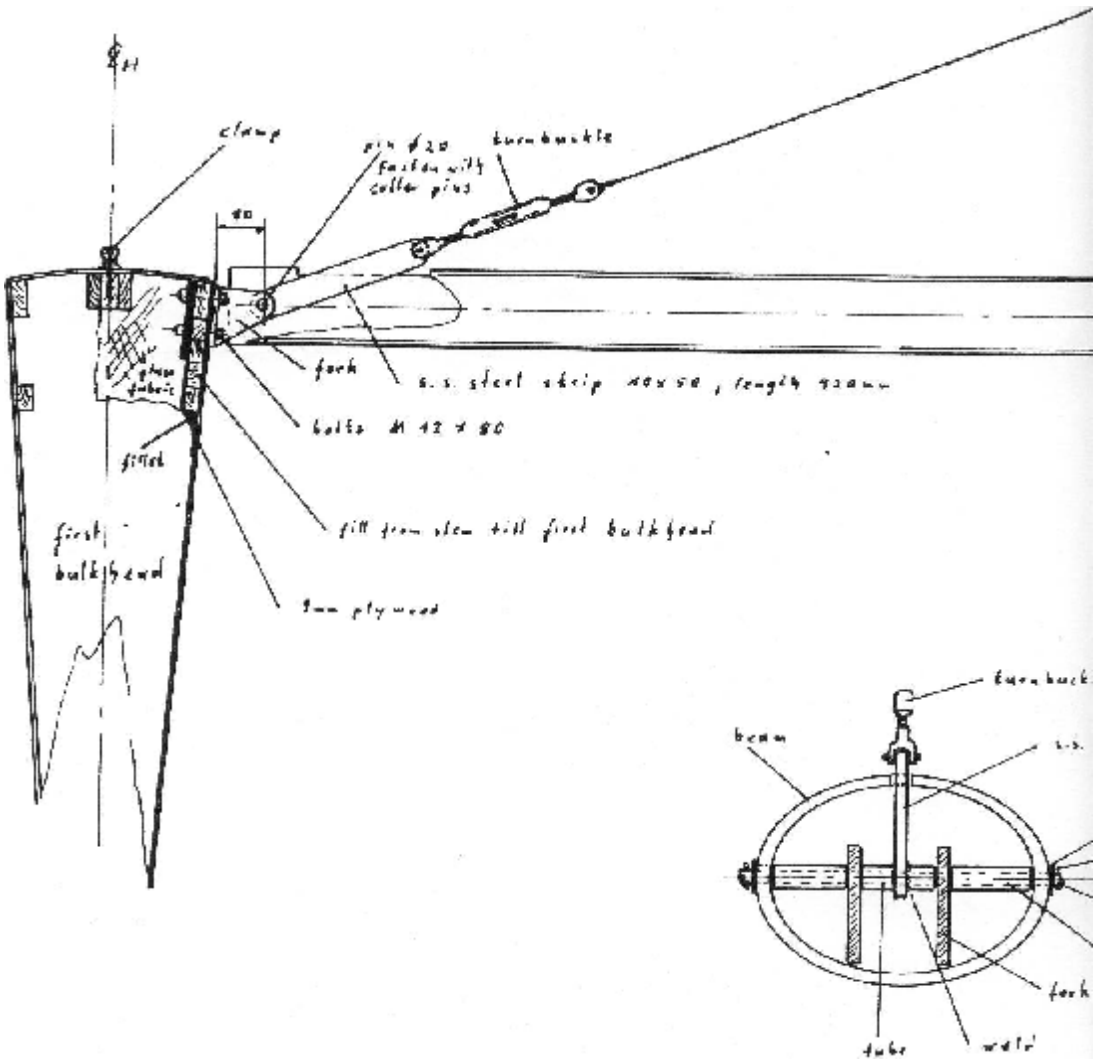
PRINTS	
R1	Rudder jig
R2	Leading edge fillet
R3	Rudder sides camped together
R4	Rudder before painting



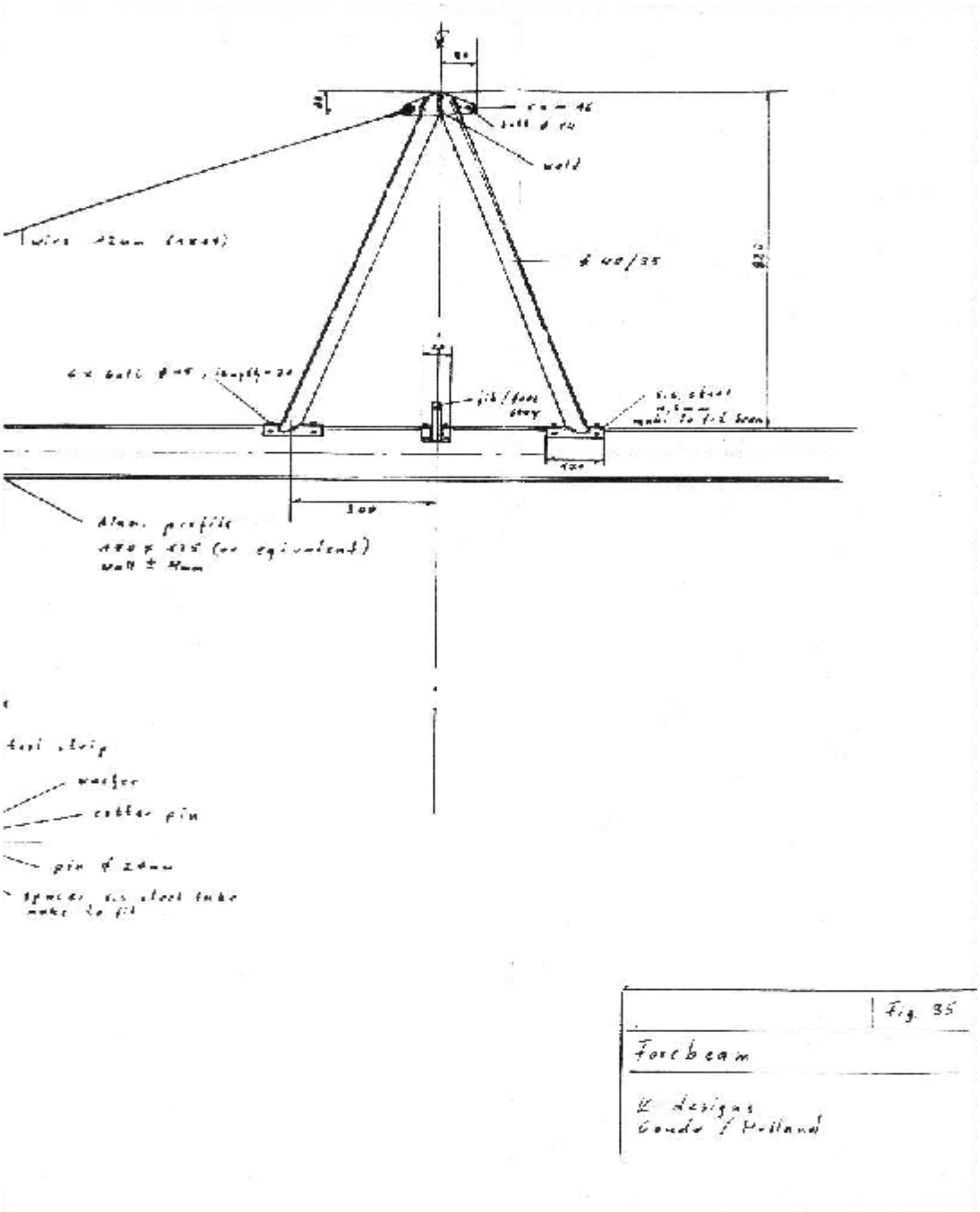
Entrance beam part 1



Entrance beam part 2



Fore beam and bulkhead structure part 1



Fore beam and Gull striker part 2

This are reduced original drawings. The plans are delivered in print and not as Ebook