

Enkhuizer Zeevaartschool

OPLEIDINGEN KLEINE HANDELSVAART EN GROTE ZEILVAART

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READER SQUARE RIGGED SAILING

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Recommended books for the Sailing Module

yellow it marking

English

****Masting & Rigging,** Harold A. Underhill ISBN 0-85174-173-8

Clipper ship & Ocean Carrier, with plans, working drawings and details of the nineteenth and twentieth century sailing ship.

****The Lore of Ships,** Int. Maritime Experts

Maritime Dictionary in drawings, also available in Dutch, Swedish & German.

****The Lore of Sail,** Int. Maritime Experts, ISBN 0-87196-221-7

Illustrated dictionary of Sail. (Pocket book)

→ only figures with naming!!

****Seamanship** John Harland, ISBN 0-87021-955-3

Seamanship in the age of Sail. An account of the shiphandling of the sailing man-of-war 1600 - 1860, based on contemporary sources.

***Tallships Down,** Daniel S. Parrott, ISBN 0-07-139092-8

The last voyages of the Pamir, Albatross, Marques, Pride of Baltimore I and Maria Asumpta.

***Bridge management for small ships** Daniel S. Parrott, ISBN 10-71550070

Dutch

****Zeilschepen en hun Tuigage,** Hidde Manhoudt, ISBN 90-228-1838-1

Different rigging types on traditional ships.

****Zeilvaart Lexicon,** J. van Beylen, ISBN 90-228-1975-2

Maritime Lexicon (4 languages)

****Beeld encyclopedie van de Scheepvaart,** Int. Maritime Experts, ISBN 90-5234-003-X

Nautical Illustrated Encyclopaedia:

****Scheepsmanoeuvres onder zeil,** H. Hazelhoff Roelfzema,

Kaap Hoorn stichting/EZS

***Het Schip & Tuig Masten Zeilen,** Mossel & Pilaar ISBN 90-302-9603-8

Rigging & construction of Dutch navy ships in the eighteen-fifties. (2 books)

***Het Tuigen van Schoenerschepen,** Th. Lehmann, ISBN 90-284-20657

The rigging, setting & dowsing of sails, repairs of traditional rigging.

German

****Bemastung und Takelung der Schiffe,** F.L. Middendorf, ISBN 3-9418-4200-5

The rigging & the construction of the last sailing ships (1903)

****Handbuch der Praktischen Seemannschaft auf Traditionellen Segelschiffen**

Jens Kusk Jensen, ISBN 3-8936-5722-3

****Seemannschaft für Großsegler,** L. Haack-Vörsman, ISBN 3-613-50166-X

Seamanship on the last category of traditional rigged sailtraining/cadet ships.

***Bemastung und Takelung von Schiffen des 18.Jahrhunderts**

Karl Heinz Marquardt, ISBN 3-7688-0526-3

***Schiffe,** Int. Maritime Experts, ISBN 3-572-01002-0

Nautical Illustrated Encyclopaedia

1.1 HISTORICAL DEVELOPMENT OF SAILING SHIPS

See also the reader; Shipbuilding large sailing ships.

There are many different types of sailing ships. It would be difficult to take you through all of these different types in this reader. So we will walk you through a short overview of them.

The development of the different types of sailing ships has and had a lot to do with a couple of aspects. Some of these aspects are:

Choice of materials and the availability of them.

In the past most sailing ships were built out of wood. This material was available in a lot of places and the shipyards were found near to the woods.

Because of the flexibility of wood ships could only be made up to a certain size.

Large ships needed so many frames inside to give them the stiffness that the weight of the empty ship by itself became too big compared to the cargo capacity.

Around 1850 iron became available for shipbuilding ships were often built in a composite construction; being a wooden hull on iron frames and beams.

Later in the nineteenth century ships were constructed completely from iron and steel.

The advantage of this was more hull space because the frames were a lot smaller in size than the wooden ones and because of the strength of steel ships became greater and greater.

The only disadvantage these steel and iron ships had was that there was no proper antifouling paint available in those days. On the wooden hulls they clad the underwater area with copper which kept the growth and worms away.

The bigger ships also needed larger sail areas so masts were becoming higher and yards longer.

Steel also began to be introduced for the lower masts and yards and in later times even aluminium and carbon is used in the rigging.

Another big change is the introduction of steel wire especially for the standing rigging, which has less stretch than the former shrouds and stays made from manila and hemp fibres.

So if you compare a frigate from the 1830 with a clipper in the 1860 you see lots of differences in shipbuilding and rigging and if you compare the latter with a windjammer from the beginning of the 20th century you will again find many changes.

The same counts for the materials which sails were and are made of. Cotton and Flax only have a certain strength and when sails become too big the fibres give way. The more modern materials such as Dacron, Oceanus, Duradon, Kevlar and Dyneema can handle a lot more wind. But bigger sails are more difficult to handle especially in stormy conditions.

Until 1850 every mast and topmast was carrying 1 sail, being the course, the topsail, the topgallant and possibly the royal. These big sails often had to be reefed when weather conditions became worse. For these jobs large crews were needed.

Around 1850 the largest sail, being the topsail, was divided into two separate sails both with their own yard. The upper and lower topsail were born. Later the same happened to the topgallant sail.

Around 1870 the labour intensive studdingsails are slowly disappearing. Through the use of steel in the rigging everything gets more sturdy high up in the masts and topmasts and topgallant and royal yards can be broader which makes the use of these labour intensive flying kites redundant.

These are the days of the windjammers, with huge sail areas divided into many sails that make it possible to have the right sail combination for many types of weather and different load lines. Sail areas of around the 4000m² are no exception.

- deadeyes → easier to cut the rig due to rope
than with baffle-screw → spinnakers

- 2 -



Trading areas

Also the trading area of a ship is influenced by the type of ship and rig. To sail the North Atlantic you need strong and heavy rigged ships, but sailing in the trade wind and tropical areas can be done with lighter and loftier ships.

When your voyages are long ocean crossings the best choice will be a rig that sails well with broad winds like a "square-rigger". For coastal voyages your choice would be a "fore and aft" rig which makes manoeuvring and tacking easier.

There are quite a few rig-types that have a little bit of both, for instance the Barquentine, the Brigantine or the Topsailschooner. These ships could be used in both of the described situations and the evolution of sail meant that there was a rig-type for any trading area.

Purpose

It is obvious that a fishing ship needed another rig than a cargo ship that was trading between Europe and Asia. For fishing the sailing had to be simple and suitable for the kind of fishing, for instance drifting behind a longline or a drifting net, the mainmast was taken down to make her move more comfortable behind her fishing gear. For a cargo or passenger ship that was making a long voyage to the other end of the world, speed was more important and the captain was keen on making a fast passage for the owners, so the crew was busy with studding sails and other kites.

The famous clippers and blockade runners were designed for speed and the amount of cargo they could carry came second place.

The windjammers in the last era of sail were made for long voyages with a lot of cargo on routes where steam was still too expensive. Often the necessary coal, needed for their engines, was not available in those ports.

Some countries also used the last big sailing ships for educating their merchant navy officers. This system meant that the running cost of these ships was reasonably low compared to their competitors.

Through the years, into modern times, it has become more and more obvious that the skills learnt by crewmembers on ocean going square riggers meet very high standards.

Skills can be trained on a simulator at a Maritime College ashore but if you want to learn team spirits and respect for the powers of weather and sea, the wet decks of a square rigger are a very good learning ground.

Last but not least there is the recreational form or cruise market for big sailing ships. Especially in the latter the guests or passengers are less involved in the actual sailing of the ship and they are there just to enjoy the sailing experience. On these ships you will find all kind of equipment to make the sailing easier and more comfortable as a small crew has to do the actual sailing of the ship.

Special Purpose Sail Training Ships have an active role for their voyage crew (paying guests) so most of the sail handling goes on in a traditional way by hand and tackle. Also the labour intensive studdingsails are flying again on these more historically rigged ships.

Economical motives

Money is always a dominant factor in trading. This was also the case in the turn of the nineteenth century. Complexity in the rigging became too expensive partly because this type of rig needed a big skilled crew. Rigging became simpler, the sky sails and royals disappeared together with the studding sails. Winches for hoisting the yards and brace winches made it possible to sail with a smaller crew. The topgallant yards became longer so the loss of the royals was compensated for. Split topsails and topgallants made reefing unnecessary. This new type of ship is called "baldheader" or jubilee rig.

In general you can say that "fore and aft" rigged ships need less crew and maintenance than "square" rigged ships. This is the reason that "ship-rigged" vessels become "barques" and big "barquentines" are built for the same reason; smaller crews and less rig maintenance.

In the above we already noticed that there are differences between fore & aft and square rig ships. Underneath is a recount of some of the advantages and disadvantages of these two different rig types.

SQUARE

Favourable for downwind & broad reaches
Good for long voyages
Rig is complex
Trained crew needed
Climbing the rig for setting sail
Safer because smaller and more sails
Easy to shorten sail
No course change needed for shortening sail
Possible to stop the ship with beam wind
MOB manoeuvre can be difficult
Heavier rig
Expensive rig
More rigging = more maintenance
Impressive sight
More crew needed
Better for crew training & teamwork

FORE & AFT

Sails closer to the wind, better for headwind
Good for coastal voyages
Rig easy to handle
Less skilled crew needed
Sails set from the decks
Big sails difficult to handle with lots of wind
Reefing big sails can be dangerous
Difficult to shorten sail down wind
Have to run into the wind to stop the ship.
MOB manoeuvre reasonably easy to perform
Lighter rig
Cheaper rig
Cheaper in maintenance

Less crew needed

1.2 DIFFERENT TYPES OF SAILINGSHIPS

The different silhouettes of sailing ships on the next page are a general classification. It is founded on different types of rig. Sometimes the kind of hull could be also named as a certain type. For instance a clipper can be rigged as a ship but also as a bark. A logger could have a schooner rig.

You can have long discussions about names, keep in mind that these forms evolved through the ages in different countries and received different names and that even the writers of standard sailing ship books don't agree about some of the names of rig types.

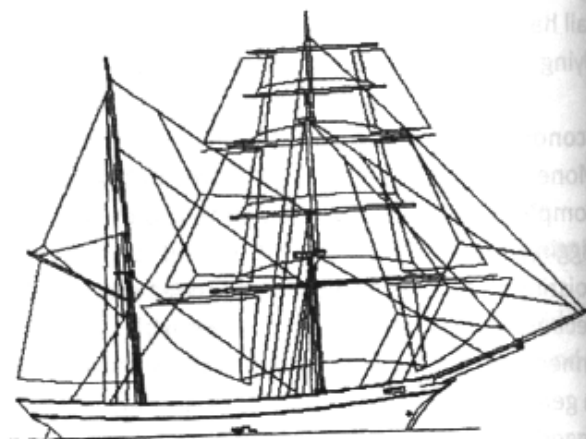
For some types of rigs there is not a proper name in some languages, for instance the name Jackass barque does not exist in the Dutch language. *guk in US brigantijn*

Confusion also exists about the Hermaphrodite Brig (*Schoenerbrik*). This type has a traditional square rigged foremast with a lower mast, a topmast and a topgallant mast. The mainmast has a lower mast and one topmast and is fore and aft rigged with a Mainsail and a gaff-topsail. Kaatje is a good example of this type of rig.

The Brigantine (*Brigantijn*): the main top also has yards, but no square mainsail and it does have a spanker. Today the names of Brigantine and Hermaphrodite Brig are often used for the same type of ship.

The Brig (*Brik*) has two masts both square rigged, beside a square mainsail she also has a spanker.

A Snow (*Snauw*) is a ship which has a secondary thinner mast behind the mainmast. The secondary mast is used for guiding the hoops and gaff of the spanker. While the original big mainmast carries the truss of the main yard.





Full-rigged Ship



3 Masted Barque



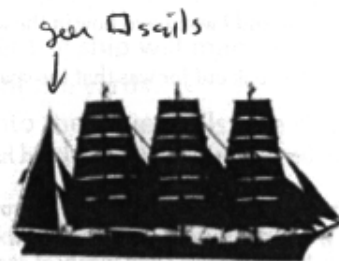
Barquentine



Brig



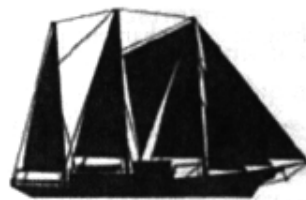
Brigantine



4 Masted Barque



3 Masted Schooner



3 Masted Staysail Schooner



2 Masted Topsail Schooner



4 Masted Schooner



Bermudian Ketch



Bermudian Yawl



Bermudian Schooner



Gaff Cutter



Gaff Ketch



Sloop



Freedom



Caravelle

About the Big Coasters

But my queerest experience in a coaster was entering a little New Brunswick port. After a dozen years of knocking round in small fore-and-aft rigged vessels one has certain ideas of how standard manoeuvres should be performed and in this case mine were all knocked galleywest.

We were approaching the entrance with a fresh breeze over our port quarter when the skipper ordered the spanker lowered. The little harbour within was quite narrow and I wondered how in the world he would be able to round up in time without the aid of the spanker; but he grinned and told me the thing to look out for was that the spanker did not "take charge" and round her to against your will in shallow water.

This was lesson number one. I was at the wheel and had a few rather nervous minutes: there was a big ground swell heaving in across the bar and in this the ship exhibited a strong tendency to round-to. At the same time she seemed to sag off bodily towards a series of ugly ledges under our lee and between the two I had plenty of exercise trying to keep her in the fairway.

The skipper meantime had gone forward to superintend hauling down the jibs. This struck me as queer but later I realized that that was the business end of the ship. Although no effort was made to secure them it took a few minutes just to drag the four big headsail down and I was all the time growing more and more anxious since we were dashing across the harbour at a lively pace and it did not look as though there was going to be room to round up.

Surreptitiously I eased off a little so as to give more room to shoot, but the skipper instantly noticed the change and waved me back on my course. When we were right in middle – just about where it seemed to me the anchor should have gone – he waved me quite nonchalantly to put my helm a-lee. I took one look at the forested, clifty shore scarcely a cable-length to windward and shied like a frightened horse.

But there was no mistaking his signals, so gritting my teeth and looking the other way I jammed the helm hard down.

She responded promptly and at the same time there came a tremendous roar: the "old man" had let go the port anchor. However, the chain ran out unchecked and I still had visions of laying her forefoot on the rocks as she continued to round up. But presently her sails started to shake and as they did so her headway diminished very fast. As she lost way, of course, she ceased to turn, so the upshot was that she came to rest in a few moments with the wind abeam – and never did actually come up into the wind it all.

Letting the anchor go was not the answer: that was done merely to range out the chain which otherwise would have lain in a heap on the bottom. The ship was so deep and her skin friction so great that despite the tremendous momentum of her loaded hull she was bound to check as soon as the power propelling her was removed.

The skipper knew this and was not at all worried about the cliffs to windward, so near. He knew she would merely spill the wind and stop. But I did not and I called that lesson number two in the art of handling a big fore-and-aft rigged freighter. I was destined to learn several more before the voyage was done.

Chapter 2 RIGGING REVIEW

A rigging review can be done by the rules of thumb that were already set by Sweijs in 1862.

The rig of a ship should, in size and position, be in harmony with the properties of the hull.

Short and broad ships will perform better with a high and narrow rig, especially close-hauled.

Long, narrow crank-sided ships should have a broad and low rig.

The Foremast should never be placed too far forward and the Mizzen not too far aft, especially not with slender hulls.

The closer the masts are to the point of gravity in the ship, the easier the ship will manoeuvre and she will react more easily in a sea. But you have to keep in mind the length of the yards.

If it was possible to put all the driving power from the higher sails into the lower sails, the ship should sail faster.

Long lower masts will make a ship faster than long top-masts.

Less raked masts will help a ship that has a lot of weather helm. Raking them more will help a ship that is weak upon the rudder.

These theses are also used by Hidde Manhoudt in his book "Zeilschepen en hun tuigage" (1946), they have not lost any of their value. Rig designers still use these rules of thumb today.

In 1901, F.L. Middendorff, the director of the Germanische Lloyd Classification Bureau published a book, called "Bemasting und Takeling der Schiffe", that became a standard reference work for sailing cargo ships in the last era of sail. In his book he deals with all kind ship and rig types that were common in those days. He specifically points out the sailing abilities and the rig-strength needed for different sizes and types of ships.

As an example from Middendorff's book, we take a Topsailschooner of 27 meters of length on page 16-20. For the completeness of the example, we are not only giving the whole calculations of the stability calculations of the rig but also the stability calculations by the rule of Simpson.

Middendorff's aim was to construct a sailing ship that was capable of fast voyages and seaworthy in hard conditions. His conclusion was that often ships were carrying too much canvass and by studying the many ship records he concluded that in general fast voyages were made by ships with a moderate sailplan.

Concerned by the great number of ships that got lost through dismasting (the Wanderer, the Austrasia, the Somali), by capsizing (the Tracia), or were reported missing (the Nation, the Ben Douran, the Dunkerque, the Caracas, the Perseverance and the 5 mast Barque Maria Rickmers) he found the causes in.

- **Bad stowage of the cargo**
- **Stability too low!**
- **Mishandling of the rig**
- **Rigging not strong enough**

Starting from the principle that the wind-pressure-force on sailing ships ($p \cdot A \cdot h \cos^2 \emptyset$) has to be met by the lifting (raising) momentum ($D \cdot MG \cdot \sin \emptyset$) and that those two should be in a proportion with each other.

This resulted in his famous seaworthy-coefficient which became a standard for seaworthiness and rigging of deepwater sailing ships.

In which A = the area of sail & rig in square meters,

h = the height of the sailing point above the lateral point in meters,

D = Displacement,

MG = Height from point of Gravity to the Metacentre

If the size of the ship (Displacement) and also the stability (MG) of the hull is known, one can calculate the necessary sail-area (A) in combination with the length of the heeling lever (h)

If you make A smaller you can make h longer which results in a higher but smaller rig.

If you make h shorter you can make A larger, which result in a larger but lower rig.

As long as the total product of A and h stays the same.

Middendorf gives in his book a value of for different types of ships, for instance topsail schooners 19,5 and schooners 16,5 (loaded and under full rig), for big square riggers with all sails set and loaded on their marks an value of 23, in ballast 17 and under stormsails 12. For ballast he takes the amount of 0,40-0,55 ton for every BRT.

He also takes in account the different sailing areas and gives for instance the value of 14 (small ships in North Sea & Baltic) to 26 (worldwide sailing area large ships).

The practical importance of this coefficient of seaworthiness lays in the fact that if you sail on a ship that fits inside the given limits of the value, you can assume you are on a manageable and seaworthy ship, as long as the sail-area is properly divided in the total rig.

Middendorf gives tables to manage the sail-area over the rig by introducing rules for :

1. How to divide the total sail-area over the "bowsprit, foremast, mainmast & mizzen".
2. The rake of the masts & angle of the bowsprit.
3. The position of the masts.
4. The position of the Sailpoint in relation to the Lateral point.

1. The spreading of sail-area on the different spars is given in exact numbers, for instance a Schooner 22,7% on the Bowsprit, 45,1% on the Foremast and 32,2% on the Mizzen.

these are not exact but relative ...

2. The rake of the masts is given in percentage by type of ship, for instance Brigantine: Fore mast 3-4%, Main mast 5-6% and Bowsprit 17-19%

3. The position of the masts is given in % of the length of the ship between the perpendiculars (L) and by ships type, for instance, the Brigantine:

Stem to centre foremast	27,9-28,5% L
Centre foremast to centre mizzen	31,3-31,6% L
Centre mizzenmast to stern	40,9-40,0% L

4. The Sailpoint should be always in front of the Lateral point and on beamy ships more then on slender ships, and on square riggers more then on fore and aft rigged ships.

For square-riggers and topsail-schooners 5,5 – 8 % L, with an average of 6,75 % L.

For schooners 1,1 – 6,7 % L, with an average of 3,9 % L.

The rules mentioned above guarantee a seaworthy ship that handle's wind and sea well and will be easy on the helm as long as the crew treats her well.

In 1980 Middendorf's book "*Bemastung und Takelung der Schiffe*" came in reprint.

This all looks as a matter of course but keep in mind that the handling of the sails is also of major importance!

Always use the following basic rules:

- Sail area should always be in balance!
- Adjust the Sail area to the course to steer!
- Keep in mind which manoeuvres could be needed, sooner or later!

2 Mast Topsail Schooner

$$L = 27 \text{ m}, \quad B = 6,57 \text{ m}, \quad H = 3,2 \text{ m},$$

Tiefgang ohne Kiel 2,81 m

" mit " 2,96 m.

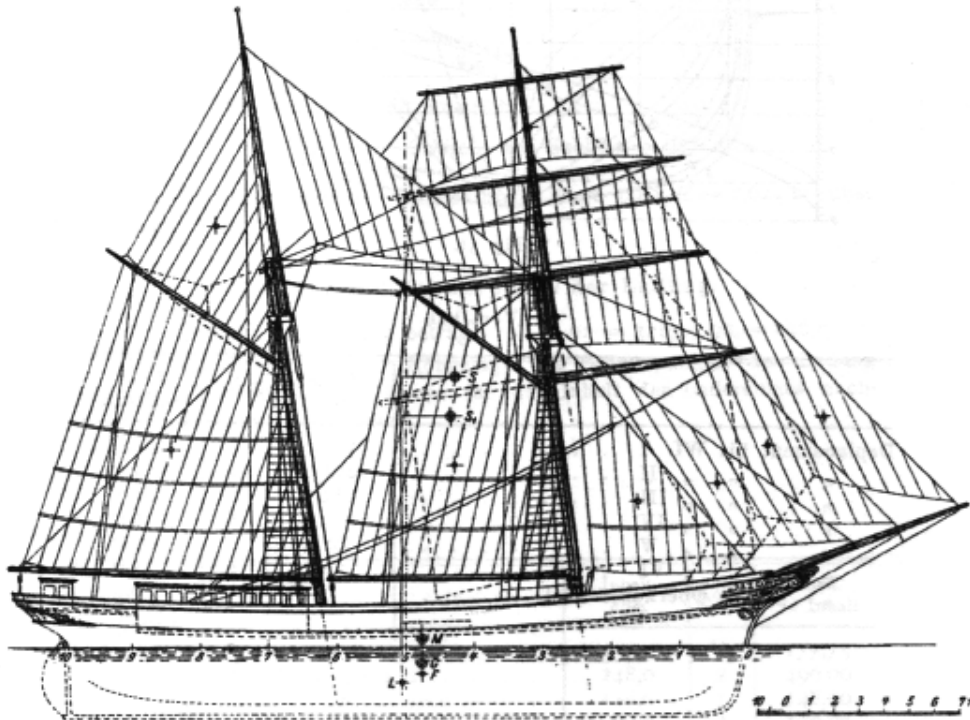


Fig. 50.

①

Displacement und Schwerpunkt desselben.

a. Horizontal.

Spanten	Areal der Spanten qm	Koeff.	Areal × Koeff.	Koeff.	Momente bezogen auf Spant 0
0	0,00	$\frac{1}{2}$	0,00	0	0,00
1	8,45	2	16,90	1	16,90
2	13,72	1	13,72	2	27,44
3	15,94	2	31,88	3	95,64
4	16,41	1	16,41	4	65,64
5	16,41	2	32,82	5	164,10
6	15,82	1	15,82	6	94,92
7	14,28	2	28,56	7	199,92
8	10,82	1	10,82	8	86,56
9	5,51	2	11,02	9	99,18
10	0,00	$\frac{1}{2}$	0,00	10	0,00
177,95				850,30	

$$\delta = 2,7; \quad \frac{2}{3} \delta = 1,8 \quad \delta = 2,7$$

$$D = 320 \text{ cbm} \quad 2295,81$$

$$D = 328 \text{ t.}$$

$$\frac{2295,81}{177,95} = 12,9 \text{ m} = \text{Depl. } \odot \text{ hinter Spant 0}$$

$$13,5 \text{ m} = \frac{1}{2} L$$

$$0,6 \text{ m} = \odot \text{ des Depl. vor der Mitte der WL.}$$

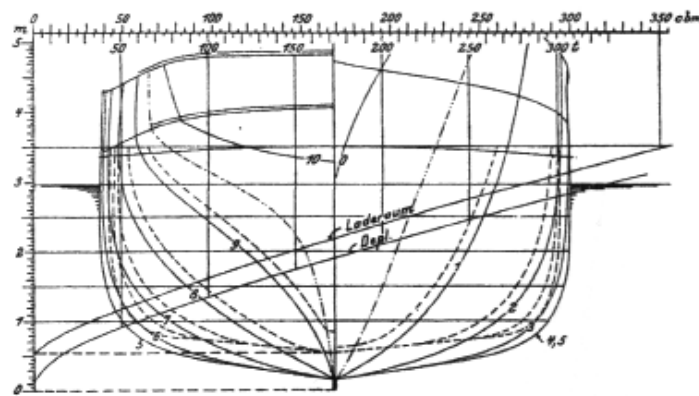


Fig. 51.

b. Vertikal.

	Inhalt cbm	Koeff.	Koeff. × Inhalt
Displacement bis WL I	320,0	$\frac{1}{2}$	160,0
" " " II	251,0	2	502,0
" " " III	184,5	1	184,5
" " " IV	123,0	2	246,0
" " " V	67,0	1	67,0
" " " VI	22,5	2	45,0
" " Oberkante Kiel	0,0	$\frac{1}{2}$	0,0
			1204,5

$$\delta = 0,468; \quad \frac{2}{3} \delta = 0,312$$

$$\text{Areal der Skala} = 375,80$$

$$\frac{375,8}{320} = 1,175 \text{ m} = \odot \text{ des Depl. unter der WL}$$

$$2,810 \text{ m} = \text{Tiefgang ohne Kiel}$$

$$1,635 \text{ m} = \odot \text{ des Depl. über Oberkante Kiel.}$$

Quer-Metazentrum.

Spanten	$\frac{1}{2}$ Breite der WL m	$(\frac{1}{2} \text{ Breite})^2$	Koeff.	Koeff. × $(\frac{1}{2} \text{ Breite})^2$
0	0,00	0,000	$\frac{1}{2}$	0,000
1	2,26	11,543	2	23,086
2	3,12	30,371	1	30,371
3	3,25	34,328	2	68,656
4	3,27	34,966	1	34,966
5	3,27	34,966	2	69,932
6	3,25	34,328	1	34,328
7	3,17	31,855	2	63,710
8	2,97	26,198	1	26,198
9	2,40	13,824	2	27,648
10	0,00	0,000	$\frac{1}{2}$	0,000
				378,895

$$\delta = 2,7; \quad \frac{4}{9} \delta = 1,200$$

$$\frac{2}{3} \int y^2 dx = 454,674$$

$$\frac{454,674}{320} = 1,421 \text{ m} = \text{Metazentrum über dem } \odot \text{ des Depl.}$$

$$1,635 \text{ m} = \odot \text{ des Depl. über Oberkante Kiel}$$

$$3,056 \text{ m} = \text{Metazentrum " " "}$$

2

Gewicht und Schwerpunkt des Schiffes.

Nach der Gewichtsdarstellung, Tafel I, ist, da $0,75 \cdot L \cdot B \cdot H = 426$ und sonach die Größe des Schiffes ca. 150 Brutto-Registertons beträgt, das Gewicht des aus Stahl gebauten Schiffes wie folgt:

Stahl- und Eisenteile	55,0 t
Holzteile	10,0 t
Ausrüstung	8,5 t
Takelung	9,5 t
Zementierung und Anstrich.	9,0 t

Gewicht des Schiffes = 92,0 t

Der \odot des kompletten Schiffskörpers liegt $0,82 \cdot H = 2,624$ m über Oberkante Kiel.

3

Gewicht und Schwerpunkt der Ladung.

Das Gewicht der Ladung beträgt: $D - 92 = 328 - 92 = 236$ t.

Für die Ermittlung der Höhenlage des Schwerpunktes der Ladung ist unter Zuhilfenahme der Kurve für den Inhalt des Laderaumes nachfolgende Rechnung anzustellen:

	Inhalt cbm	Koeff.	Koeff. \times Inhalt
Laderaum bis Deckebene I	355,5	$\frac{1}{2}$	177,75
" " Ebene II	248,0	2	496,00
" " " III	148,6	1	148,60
" " " IV	60,0	2	120,00
" " Oberkante Wegerung	0,0	$\frac{1}{2}$	0,00
			942,35

$$\delta = 0,74; \quad \frac{2}{3} \delta = \frac{0,493}{464,578}$$

$$\frac{464,578}{355,5} = 1,307 \text{ m} = \odot \text{ der Ladung unter der Deckebene}$$

$$3,340 \text{ m} = \text{Deckebene über Oberkante Kiel}$$

$$2,033 \text{ m} = \odot \text{ der Ladung über Oberkante Kiel.}$$

4

Systemschwerpunkt.

Nach dem Vorstehenden ergibt sich folgende Aufstellung:

Loaded!

	Gewicht t	\odot über Oberk. Kiel m	Momente
Schiffskörper	92	2,624	241,408
Ladung	236	2,033	479,788
$D =$	328		721,196

$$\frac{721,196}{328} = 2,199 \text{ m} = \text{System } \odot \text{ über Oberkante Kiel}$$

$$3,056 \text{ m} = \text{Metazentrum über Oberkante Kiel}$$

$$MG = 0,857 \text{ m} = \text{ " " dem System } \odot.$$

5

Segelsystem.

Schiffe von dieser Größe werden vorzugsweise für die große Küstenfahrt benutzt, es muß deshalb $\frac{A \cdot h}{B \cdot MG}$ innerhalb der Grenzen von 17 bis 19 gehalten werden.

Nach den unter „Anfertigung der Segelzeichnung“ (2. Teil, I. Abschn., B, s. Seite 64) angegebenen Verhältniszahlen muß das ganze Segelareal A wie folgt verteilt werden:

0,227 · A auf die Vorsegel
0,451 · A „ „ Segel am Fockmast
und 0,322 · A „ „ „ „ Großmast.

Unter Berücksichtigung dieser Angaben läßt sich nun die Segelzeichnung entwerfen und nachfolgende Berechnung des Segelmomentes anstellen (s. Fig. 50):

a)

Areal und Schwerpunkt der sämtlichen Segel.

Benennung der Segel	Areal in qm	Über der Wasserlinie		Vor der Mitte der WL	
		Abstand des \odot s m	Momente	Abstand des \odot s m	Momente
Großsegel	96,7	8,02	775,53	— 9,30	— 899,31
Gaffeltoppsegel	36,8	17,10	629,28	— 7,50	— 276,00
Schonersegel	74,2	7,40	549,08	1,90	140,98
Unteres Toppsegel	43,3	13,28	575,02	5,81	251,57
Oberes „	38,7	17,10	661,77	5,50	212,85
Bramsegel	30,7	21,00	644,70	4,94	151,66
Stagfack	25,7	5,85	150,35	9,20	236,44
Binnenklüver	21,7	6,55	142,13	12,36	268,21
Klüver	25,0	8,17	204,25	14,34	358,50
Außenklüver	21,8	9,30	202,74	16,55	360,79
Areal A =	414,6		4534,85		1981,00
Breitfack	100,0				— 1175,31
Flieger	28,0				+ 805,69
Total =	542,6				

$$\frac{4534,85}{414,6} = 10,938 \text{ m} = \text{Segel } \odot \text{ über der WL}$$

$$1,480 \text{ m} = \odot \text{ des Längenplans unter der WL}$$

$$h = 12,418 \text{ m} = \odot \text{ der Segel über dem } \odot \text{ des Längenplans.}$$

$$\frac{805,69}{414,6} = 1,943 \text{ m} = \odot \text{ der Segel vor der Mitte der WL}$$

$$0,150 \text{ m} = \odot \text{ des Längenplans hinter der Mitte der WL}$$

$$\frac{2,093 \text{ m}}{0,0776 \cdot L} = \odot \text{ der Segel vor dem } \odot \text{ des Längenplans.}$$

$$\text{Ferner ist: } \frac{A \cdot h}{B \cdot MG} = \frac{414,6 \cdot 12,418}{328 \cdot 0,857} = 18,32.$$

Für die unteren Segel berechnet sich das Stabilitätsverhältnis wie folgt:

Areal und Schwerpunkt der unteren Segel.

Benennung der Segel	Areal in qm	Über der Wasserlinie		Vor der Mitte der WL	
		Abstand des \odot s m	Momente	Abstand des \odot s m	Momente
Großsegel	96,7	8,02	775,53	— 9,30	— 899,31
Schonersegel	74,2	7,40	549,08	1,90	140,98
Unteres Toppsegel	43,3	13,28	575,02	5,81	251,57
Oberes "	38,7	17,10	661,77	5,50	212,85
Stagfock	25,7	5,85	150,35	9,20	236,44
Binnenklüver	21,7	6,55	142,13	12,36	268,21
Klüver	25,0	8,17	204,25	14,34	358,50
Areal $A_1 =$	325,3		3058,13		+ 1468,55
					— 899,31
					+ 569,24

Standard placing & angle for tops & bowsprits on different types of ships

Barks.

Entf. von Vorkante Vorsteven bis Mitte Fockmast . . .	0,2085—0,220 · L
" " Mitte Fockmast bis Mitte Großmast . . .	0,3488—0,342 · L
" " " Großmast " Besahnmast . . .	0,2719—0,270 · L
" " " Besahnmast " Hinterkante Hintersteven .	0,1708—0,168 · L

Fall der Masten:

Fockmast	3—4 1/2 Grad	Besahnmast	5 1/2—6 Grad
Großmast	5 " "	Steigung des Bogsprits	17—19 "

Schonerbarks.

Entf. von Vorkante Vorsteven bis Mitte Fockmast . . .	0,2057 · L
" " Mitte Fockmast bis Mitte Großmast . . .	0,2982 · L
" " " Großmast " Besahnmast . . .	0,2825 · L
" " " Besahnmast " Hinterkante Hintersteven .	0,2136 · L

Fall der Masten:

Fockmast	3—4 Grad	Besahnmast	5—6 Grad
Großmast	4—5 1/2 " "	Steigung des Bogsprits	17—19 "

Briggs.

Entf. von Vorkante Vorsteven bis Mitte Fockmast . . .	0,246 · L
" " Mitte Fockmast bis Mitte Großmast . . .	0,407 · L
" " " Großmast " Hinterkante Hintersteven .	0,347 · L

Fall der Masten:

Fockmast	3—4 Grad
Großmast	4—5 " "
Steigung des Bogsprits	17—19 "

Schonerbriggs.

Entf. von Vorkante Vorsteven bis Mitte Fockmast . . .	0,2788—0,2845 · L
" " Mitte Fockmast bis Mitte Großmast . . .	0,3125—0,3155 · L
" " " Großmast " Hinterkante Hintersteven . . .	0,4087—0,4000 · L

Fall der Masten:

Fockmast	3—4 Grad
Großmast	5—6 "
Steigung des Bugspriets	17—19 "

Dreimasttoppsegelschoner.

Entf. von Vorkante Vorsteven bis Mitte Fockmast	0,197 · L
" " Mitte Fockmast bis Mitte Großmast	0,335 · L
" " " Großmast " " Besahnmast	0,275 · L
" " " Besahnmast " Hinterkante Hintersteven	0,193 · L

Fall der Masten:

Fockmast	3—4 Grad	Besahnmast	6—6½ Grad
Großmast	4½—5 "	Steigung des Bugspriets	17—19 "

Dreimastschoner.

Entf. von Vorkante Vorsteven bis Mitte Fockmast	0,2000 · L
" " Mitte Fockmast bis Mitte Großmast	0,2983 · L
" " " Großmast " " Besahnmast	0,2822 · L
" " " Besahnmast " Hinterkante Hintersteven	0,2195 · L

Fall der Masten:

Fockmast	3½—4 Grad	Besahnmast	5½—6 Grad
Großmast	4½—5 "	Steigung des Bugspriets	17—19 "

Schoner.

Entf. von Vorkante Vorsteven bis Mitte Fockmast	0,265—0,250 · L
" " Mitte Fockmast bis Mitte Großmast	0,348—0,362 · L
" " " Großmast " Hinterkante Hintersteven	0,387—0,388 · L

Fall der Masten:

Fockmast	3—7 Grad
Großmast	4½—8 "
Steigung des Bugspriets	17—19 "

Dreimastgaffelschoner.

Entf. von Vorkante Vorsteven bis Mitte Fockmast	0,2—0,170 · L
" " Mitte Fockmast bis Mitte Großmast	0,3—0,296 · L
" " " Großmast " " Besahnmast	0,3—0,296 · L
" " " Besahnmast " Hinterkante Hintersteven	0,2—0,238 · L

Fall der Masten:

Fockmast	2—4 Grad
Großmast	2½—5 "
Besahnmast	3—6 "
Steigung des Bugspriets	15—18½ "

Chapter 3 RIGGING

3.1 Masts & Spars

Depending on the size of the ship, a sailing ship has a number of tops or masts.

The words Top and Mast are often used for the same item.

Officially we speak of Tops because a Top is build up out of different sections and a Mast is just one single spar. In general a Square Rigged Top is build up out of 3 sections and a Fore & Aft rigged Top out of 2.

The names are for a square rigged top: Lower Mast, Top Mast, t'Gallant Topmast, Royal Topmast, Skysail Topmast. The names for a Fore & Aft rigged top: Lower Mast and Top Mast.

Through the ages, ships became bigger and single masts were becoming a problem because the trees for those sizes masts were not available anymore. Riggers started to build up tops out of different sections. The advantage of this structure was also that, in case of an accident, parts of the mast could be saved and that the damage could be contained to only one or two topmasts instead of losing the complete top. Around 1870 they started to make the lower masts and lower yards out of riveted steel plates, while topmasts and yards were still made out of wood. Today, topmasts and yards are often made out of aluminium to keep the total weight of the rigging as low as possible.

In the past it was important that the ship's crew was able to do repairs and all the maintenance on the rigging, and proper pieces of pine were often difficult to get outside of Europe or Northern America, so ships were carrying spare pieces of pine on deck for possible repairs of different spars in the rigging.

Another advantage of this construction was that t'Gallant masts could be send down to deck, together with their yards, when a ship was sailing in ballast. In this way they improved the stability of the ship and less ballast was needed to take in when sailing without cargo.

Today the lowering of t'Gallant masts still happens when square riggers are transiting through canals or rivers with obstacles like power cables or bridges (e.g. Nord-Ostsee Kanal)

In general the t'Gallant and the Royal topmast are one spar but with the different names still given to those sections of the spar. Even the Skysail top was often part of that same long t'Gallantmast.

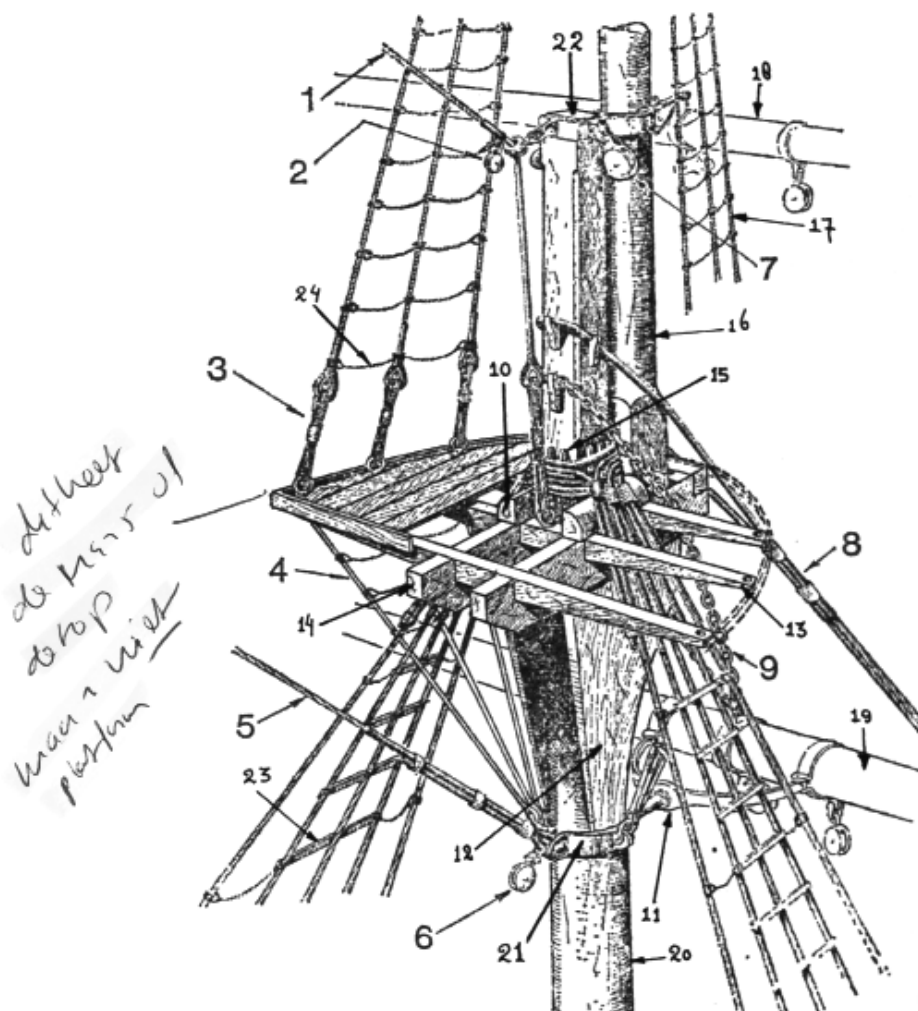
In the early 1900's not only the lower masts were made out of steel, also the topmast often became part of that same mast, but again the names of lower mast and topmast were kept. The few cargo square riggers that are still with us, like *Kruszhenstern* (ex *Padua*) and *Sedov* (ex *Magdalene Vinnen II*) have Tops constructed in this way. But for instance also the new build *Alexander van Humboldt II* has a combined lower & topmast construction.

A Snow-Brig has close behind her Main Lower mast an extra thinner spar called the Snow mast. This extra spar was use to guide the jaws and hoops of the Spanker.

Tops are always rigged with a bit of rake, meaning that they lean backwards a bit.

The rake of the tops means that the support given by the construction of shrouds and backstays becomes sturdier. At the same time this rake makes the lifting of the bow for the ship easier. This is especially important for ships that have a fine or narrow entrance in the bow. Clipper ships quite often have and had these kind of lines in the bow which had the disadvantage that the fore ship had little lifting capabilities compared to ships with a more full build bow shape. An extreme example of masts with lots of rake is of course the Baltimore clippers (*Pride of Baltimore*). These ships were fast and could point high, especially in light breezes, compared to the more bulky ships of the English during the war of independence. In general you can say that the different masts have a little more rake from fore to aft in square riggers. Schooners have the same rake on all of their masts.

↳ rake is increasing from fore to aft



Drawing of a Fore Top

- 1= Main t'gallant stay
- 2= Block downhaul main t'gallant staysail
- 3= Riggingscrews
- 4= Futtock shrouds
- 5= Main Topmast stay
- 6= Block downhaul main topmast staysail
- 7= Toppinglift block Fore yard
- 8= Fore Stay
- 9= Fore Course yard tye (=lashing)
- 10= Bolster
- 11= Foreyard Truss
- 12= Cheeks
- 13= Crosstrees
- 14= Trestletrees
- 15= Battens
- 16= Foretopmast
- 17= Foretopmastshrouds
- 18= Fore lower topsail yard
- 19= Fore course yard
- 20= Fore lower mast
- 21= Futtockband
- 22= Cap
- 23= Ratboards
- 24= Ratlines

- GrootBramstengestag
- Blok neerhaler grootbramstengestagzeil
- Wantspanners
- Putting want
- Groot Stengestag
- Blok neerhaler grootstengestagzeil
- Blok Toppenend Fokke ra
- Voorstag
- Ketting rak Fokkera
- Kalf of Kussen
- Fokkera rak
- Wangen
- Zaling (dwars)
- Langszaling
- Keggen
- Voorsteng
- Voor stenge want
- Voor ondermars ra
- Fokke ra
- Voor onder mast
- Puttingband
- Ezelshoofd
- Weeflatten
- Weeflijnen

Types of square rigged vessels:

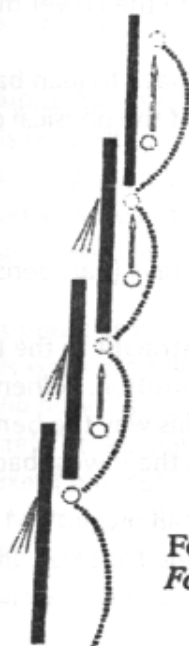
Names in English (Dutch)

2 masts	Brig (Brik)	Brigantine (Brigantijn)	
3 masts	Ship/ Fregat (volschip)	Barque (Bark)	Barquentine (Barkentijn)
4 masts	Ship/ Fregat (volschip)	Barque (Bark)	Barquentine (Barkentijn)
5 masts	Ship/ Fregat (volschip)	Barque (Bark)	Barquentine (Barkentijn)
	All masts square rigged	Only aft mast not square rigged <i>the end of rigging</i>	Only fore mast Square rigged

Masts

Names in English (Dutch)

2 masts	Fore mast (fokke mast)	Main mast (Grote mast)			
3 masts	Fore mast (fokke mast)	Main mast (Grote mast)	Mizzen mast (bezaan/kruis mast)		
4 masts	Fore mast (fokke mast)	Main mast (Grote mast)	Mizzen mast (bezaan/kruis mast)	Jigger (Bezaan)	
5 masts	Fore mast (fokke mast)	Main mast (Grote mast)	Middle mast (midden mast)	Mizzen mast (Kruis mast)	Jigger (Bezaan)



Bovenbram, scheizeil
Royal

Bram
Topgallant

Mars
Topsail

Fok / Grootzeil
Fore / main course



Bovenbram
Royal

Topbram/middenbram
Upper TopGallant

Onderbram
Lower TopGallant

Bovenmars
Upper TopSail

Ondermars
Lower TopSail

Fok / Grootzeil
F / M Course

3.2 Standing Rigging

The Tops are supported by the standing rigging.

We distinguish the following different parts of the standing rigging:

- 1 **Shrouds**, are supporting the mast & topmasts in athwart ships direction.
- 2 **Backstays**, are supporting the topmasts backwards.
- 3 **Stays**, are supporting the mast & topmasts in a forward direction.
- 4 **Stays of bowsprit & jib boom.**

1. Shrouds (wanten)

The lower mast is supported by the lower shrouds. Often these are setup as pairs that make a loop around the top of the lower mast where the construction of cheeks & trestletrees (wangen & langszalingen) keep them in the proper position and where bolsters (kalf of kussens) take care that the shrouds make no sharp angles and battens (keggen) of hardwood make sure that they don't pull grooves in the relatively soft pinewood of the mast.

In the past when shrouds were made of hemp it was important to have a good spread of the shrouds due to stretch. To make the angle larger, channels were made on the outside of the hull where the shrouds were connected to the Chain plates. Deadeyes (jufferblokken) were used to keep the shrouds under tension. The first change came with the use of wire for the shrouds which is not only a lot stronger than hemp but also has far less stretch and did not shrink when they become wet. The second step was the rigging screws (spanners) instead of the deadeye for keeping the shroud under the right tension. Channels were not needed anymore which made the mooring of ships alongside quaysides a lot easier. For climbing in the rigging ratlines (weeflijnen) are lashed horizontally between the shrouds. Just above the Deadeyes or Rigging screws are wooden or steel sheer-poles connected between the shrouds to keep the Rigging screws from turning and becoming loose. On different heights in the rigging the rope ratline is replaced by a wooden rat boards. This board keeps the shrouds at the proper distance from each other and has extra holes for the lead of the running rigging.

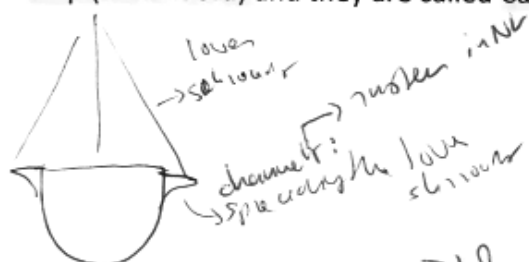
The topmasts are also supported by shrouds, being the topmast-shrouds, they run from the topmast crosstrees (zaling) to the Top where they are connected to dead-eyes or rigging-screws. These shrouds also have ratlines for climbing. The upward pull of these topmast shrouds on the Top is balanced by the Futtock Shrouds (putting want). Commonly these are made out of steel bars that run around the rim of the Top from the lower deadeyes or rigging-screws to the Futtock band (rakband) around the Lower mast a couple of meters underneath this Top. This steel band also holds the Lower-yard-truss.

These Futtock Shrouds are a crucial hindrance in climbing the rig, because you have to lean backwards to climb them. So permanent crew is using this obstacle to get a good indication of the physical condition of their trainees when they are climbing the rig.

2. Backstays (Pardoens)

To resist the forward pull of the masts and topmasts they are rigged with Backstays (Pardoens). These stays are named after the topmast they are supporting.

They are connected on chain plates on deck placed aft of the shrouds and run straight to the topmast and support the topmasts in the spots where the yards are placed in their hoisted position. (When sails are set). This is also the position where the Stays are supporting the topmasts. In this way the bending of these topmasts is kept under control. If a ship is rigged with lower and upper topsails the lowest backstays are connected to the Cap (Ezelshoofd) and they are called Cap stays (Topwanten).



of course: piece = hunched to mast at truss.

The truss of the lower topsail is also connected to this same Cap and the Cap stays are supporting this yard. When a ship has single topsails these Cap stays are not necessary. If we look further up and back we will find the Topmast-Backstays (Marsstengepardoens), further up we will find the Topgallant-Backstays (Bramstengepardoens), the Royal-Backstays (Bovenbram-Pardoens) and possibly the Skysail-Backstays (Scheizeilpardoens).

3. Stays (Stagen)

Fore and aft Stays are set up between their respective hounds (hommers) and the deck, or between hounds and a lower point on the mast forward of the one to which they belong. The stays are named after the masts and tops where they lead to. The Forestay (Voorstag) leads to the Foremast (Fokkemast). The Mainstay (Grote stag) supports the Main mast (Grote mast) and the Mizzen stay is doing the same for the Mizzen mast (Bezaan mast). In general these stays are doubled and have a loop around the top of the mast. If we go higher up we will find the Topmast-stay (Stengestag), the Topgallant-stay (Bramstag) and Royal-stay (Bovenbramstag). The topmast stays are in general also leaders for staysails.

In these days, all of the standing rigging is made out of wire. For protection they are Wormed, Parcelled and Served. (*Trenzen, smarten & kleden*). Worm & Parcel with the Lay, Serve the other Way.

An eye can be made by swaging (Talurit terminal) or through seizings. (Bindnels). When the old fashion seizings are used, there should be at least 3 of them named from top to bottom End, Middle and Throat seizing, (Pop, Hart & Knijpbindsel). The end of the stay should be capped with a copper cap or a coin to prevent moisture working its way down the lay.

The tensioning of the standing rig is done by Rigging-screws (turnbuckles) (Spanschroeven) or with Lanyards and Deadeyes (Talrepen en Jufferblokken). Rigging-screws are preserved by filling them with grease and then covered with sailcloth. (*batte screws*)

Protection of the standing rigging against Chafing (Schavielen) is done through baggy wrinkles (schurftplattingen) and other protection materials like leather and sailcloth.

4. Standing rigging of the Bowsprit & Jib boom

Tall ships carry a Bowsprit (Boegspriet) and or a Jib boom (Kluiverboom) to bring the Sail point (centre of effort of sail) sufficiently to the front. The Bowsprit can be made out of one piece (Spike), or it can be made out of different pieces for the same reason as this is done with the tops. Then you will have a Bowsprit (Boegspriet), a Jib boom (Kluiverboom) and possibly a Flying Jib boom (Jaaghout). The Bowsprit and the Jib boom are just like a mast and a topmast connected to each other by a Cap (Ezelshoofd) only in this position it is called Bowsprit-cap (Schild).

Thwart-ship support of the Bowsprit & Jib boom

The bowsprit is supported by the Bowsprit guys (Boegstagen).

The jib boom is supported by the Guys (Geien).

To achieve a better spread for these Jib boom-guys, Catheads (Kraanbalken) and Whisker booms (Voelhoorns) are rigged in the bow.

Fore and aft support of the Bowsprit & Jib boom

The Bowsprit is supported downwards by the Bobstay (Waterstag). The Bobstay can be a heavy chain or a steel bar. The Jib boom is supported downwards by the Martingale-stays (Stampstagen) and the Jib boom-stay (Snavelstag). These (chain) stays are running from different points on the Jib boom to the Martingale or Dolphin striker (Spaanse ruiter of Stampstok). From the Martingale to the hull or Catheads these stays are called the Martingale Backstays (Achteruithouders).

Underneath the Bowsprit and Jib boom you will often find a safety net. Sometimes there are only footropes (Paarden). On the Bowsprit and Jib boom you will find Jackstays and Safety-wires.

Chapter 4 Rigging

4.1 The Yards

The yards are made of wood or metal and they are made to spread and carry the square-sails. They are positioned in front of the mast and topmasts and their names are related to them.

The lower masts are carrying; the Fore Lower-yard (Fokke-ra), The Main-yard (Grote-ra) and the Crossjack-yard (Begijne-ra)

The Topmasts are carrying; the Topsail-yard (Marse-ra) or a Lower & Upper-Topsail-yard (Onder & Boven Marsera).

The Topgallant masts are carrying the Topgallant-yard (Onder-Bram-ra) and the Royal-yard (Boven-Bram-ra) and possible a Sky-sail-yard. (Scheizeil-ra)

For all these yards you have to add the name of the mast that the yard is connected to. So for instance the Main-Royal-yard (Groot-Boven-Bram-ra) or the Fore-Skysail-yard (Voor-Scheizeil-ra).

The yards can be fixed on the tops they belong to or they can be "running yards"

The fixed yards are connected to their masts and topmasts by a "Truss" (Rak) through this Truss the yard can move in the horizontal and vertical plane.

Fixed yards are; the Lower-yards, the Lower Topsail yards and if the ship has split Topgallant sails, the Lower-Topgallant yards. On some ships all the yards are fixed.

The running yards are connected with their topmast through a Parrel (Kuiprak of Sledarak). This Parrel slides up and down around the topmasts through the use of a Halyard. Running yards are; the (Upper)-Topsail yards, the (Upper)-Topgallant yards the Royal yards and the Skysail yards. All these yards are can move in the horizontal plane (Bracing) and in the vertical plane (Topping or Cockbilling).

Different parts on a yard

- **Jackstay:** *rechter* A steel bar on the yard to bend the sail on and a handgrip for the sailor when he is working aloft. Big ships have 2 jackstays on a yard.
- **Topping lift:** *toppenlift* When a running yard is in his lower position (sail not hoisted) the yard is hanging in the 2 topping lifts to keep him in a steady horizontal position.
- **Footrope:** *voetrop* A line underneath the yard used to stand on for the sailor when working on the yard.
- **Stirrup:** *springen* Vertical support- line connected to the Jackstay and the Footrope to give the footrope a more equal distance along the whole length of the yard.
- **Flemish Horse:** *hulpvoet* Small footrope on the end of the yardarm.
- **Arm beackets:** Small loops connected to the jackstay to put your arm through for safety. (Old fashioned)
- **Safety Jackstay:** *veerhaken* Safety wire on top of the yard to hook your safety harness on. (Modern)
- **Back rope:** *achterrop* Safety wire behind your back (when standing on the footrope) to hook your safety harness on. (Modern)

The yards can also have Studding-sail-boom-irons these are being used for rigging the studdingsail booms which can carry extra sails in favourable conditions.

The Mizzen or Jigger mast will be rigged with a Boom (Giek) and a Gaff (Gaffel). They are connected to the lower mast by a Gooseneck (Lummel). Some large barques even have two standing Gaffs.

cockbilling \Rightarrow *naar verticaal huppen*
haciën



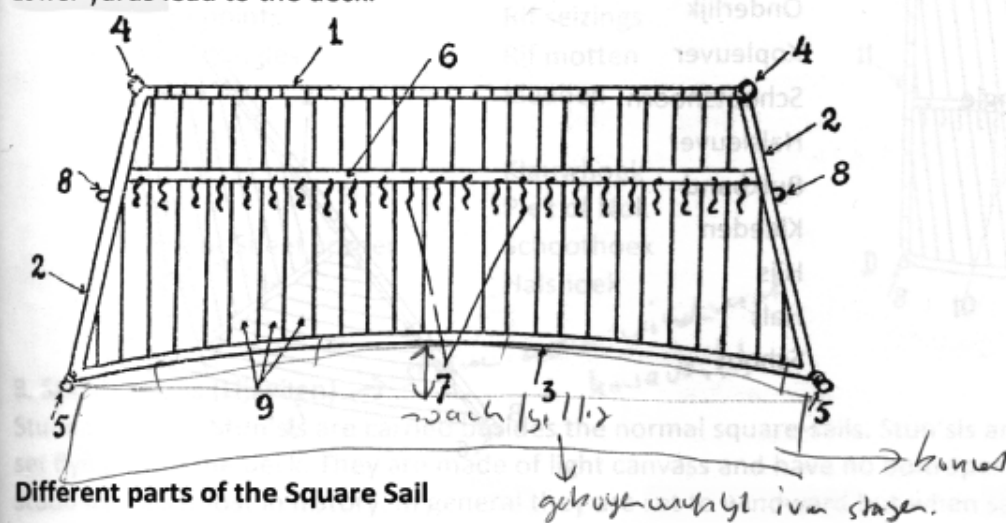
4.2 The Sails

On Square rigged ships we will find the following sails.

1. **Square Sails**, these are tied to the yards
2. **Fore & Aft Sails**, we distinct Stay Sails & Gaff Sails.
3. **Studding Sails or Stun'sls** (Lij zeilen). These sails are being used alongside the normal square-sails on the studdingsail booms

1. Square Sails

These Sails receive their names from the yard they are bent on to. They are bent with Robands (Kramgarens) on to the Jackstay. The Sheets (Schoten) are pulling the sheet-corners to the lower positioned yard and are reeved through sheet blocks on the yardarms. The sheets of the sails from the lower yards lead to the deck.



Different parts of the Square Sail

- 1 = Head
- 2 = Leech
- 3 = Foot
- 4 = Head Earing
- 5 = Clew Irons
- 6 = Reef band
- 7 = Reef points
- 8 = Reef cringles
- 9 = Cloth

- Ra-lijk
- Staande-lijk
- Onderlijk
- Nok leuwer
- Schoothoornbrillen
- Rif band
- Rif seizings
- Rif motten
- Kleed

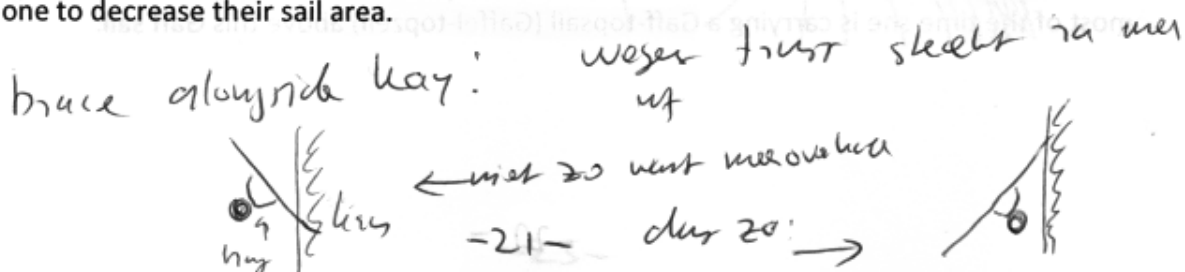
(Connected to the Jackstay with Robands)

(The Cloth of the sail are the widths of canvas which are sewn together to form the sail)

Square sails are relatively easy to change. If the ship sails to an area where she can expect heavy weather, the heavy (new) sails are bent on. In light weather areas the older sails are used.

The lower sails and the topsails are made out of the heaviest canvass. The higher sails are made of lighter canvass.

The boltrope of a square sail is always sewn to the backside of the sail. (Old fashion). The foot of a square sail is always cut a bit in a bend upwards, this is called the Roach (Gilling). The foot of the upper topsails and upper topgallants is nearly cut straight because there are no stays in these positions to interfere. Some square sails have a Reef band with Reef points and Reef cringles. You can find reefs on the bigger square riggers in the lower sails, Upper-Topsails and Topgallant sails. Smaller ships just strike the square sails one by one to decrease their sail area.



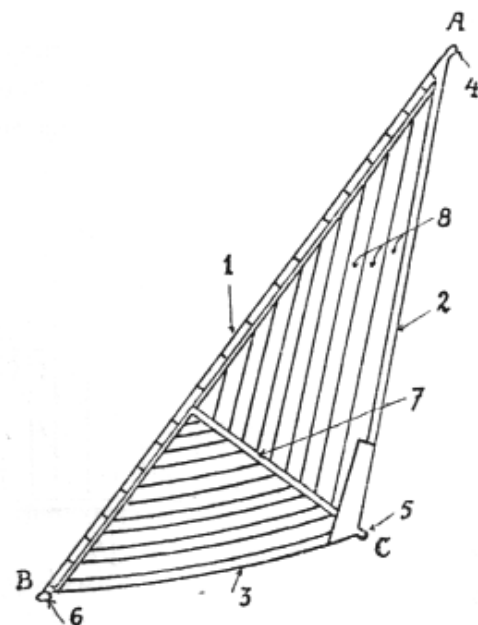
2. Fore and Aft Sails

Staysails & Jibs (Snijzeilen)

Fore and Aft Sails set on stays are either stay-sails or jibs according to their position. Stay-sails are as a rule triangular in shape, although there are a few old fashion exceptions. Hanks (Leuvers) are used to connect the sails to the stays.

Different parts of a Staysail

1 = Luff rope (Fore leech)	Voorlijk
2 = Lee rope (Aft leech)	Achterlijk
3 = Foot rope	Onderlijk
4 = Head cringle	Kopleuver
5 = Clew or Sheet cringle	Schootshoorn
6 = Tack cringle	Halsleuver
7 = Girth band	Buikband
8 = Cloth	Kleeden
A = Head	Hijs
B = Tack	Hals
C = Clew	Schoot



Fore and Aft Sails are hoisted with the Halliard (Val) and taken down with the Downhaul (Neerhaler), both connected to the Head. (Nok).

The Luff is set tight with a Purchase (Striets-talie) on the standing part of the Halliard or she is set tight with a Tack-tackle (Halstalie).

The Sheets of the Staysails lead to the deck. Staysails can also have Boltropes (Lijken).

In Holland the Boltropes are sewn to the portside of the sail.

Gaff sails (Gaffelzeilen)

A Gaff sail set on the aftermost mast of a square-rigger is always the Driver (Broodwinner) or Spanker (Bezaan of Spanker bij een Brik - Brikzeil), while gaff sails on any other square-rigged mast are known as Spencers. The Gaff sail can have a Standing Gaff or a Gaff that is hoisted with a Throat and a Peak-Halliard. The Standing Gaff is kept in the right position by a chain running to the top of the lower mast. From the peak of the Gaff there are 2 Vangs or Gaff-preventers (Gaffelgeerden) running to the deck. One on Starboard and one on port. Some of the bigger bark-ships have 2 standing gaffs above each other. (German design). The Head of the Gaff sail is hauled out along the gaff with a Peak-outhaul. The head is connected to slides that run through a rail on the gaff. The Clew is pulled home by the Foot or Clew-outhaul. If the ship is rigged as a bark most of the time she is carrying a Gaff-topsail (Gaffel-topzeil) above this Gaff sail.

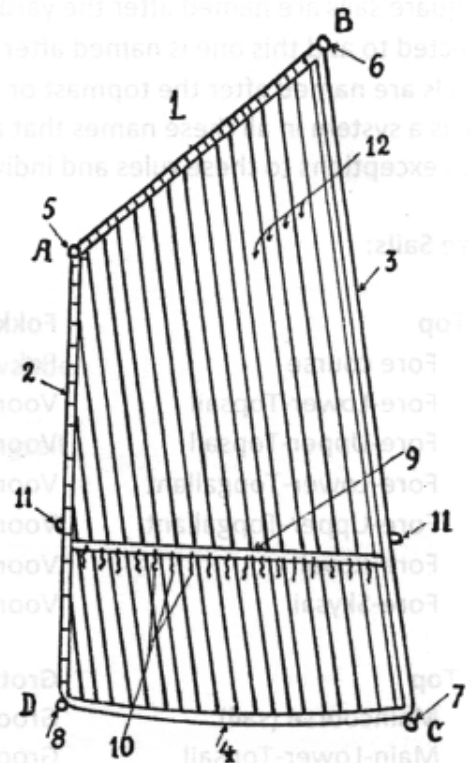
Different parts of the Gaff sail

- 1 = Headrope
- 2 = Luff rope or Fore leech
- 3 = Lee rope or Aft leech
- 4 = Foot leech
- 5 = Throat cringle
- 6 = Peak cringle
- 7 = Clew or Sheet cringle
- 8 = Tack cringle
- 9 = Reef band
- 10 = Reef points
- 11 = Reef cringles
- 12 = Cloth

- A = Throat
- B = Peak
- C = Clew or Sheet corner
- D = Tack

- Gaffellijk
- Voorlijk
- Achterlijk
- Onder of Schoots lijk
- Klauw of Rak leuver
- Piek of Nok leuver
- Schoots (hoorn) leuver
- Hals leuver
- Rif band
- Rif seizing
- Rif motten
- Kleeden

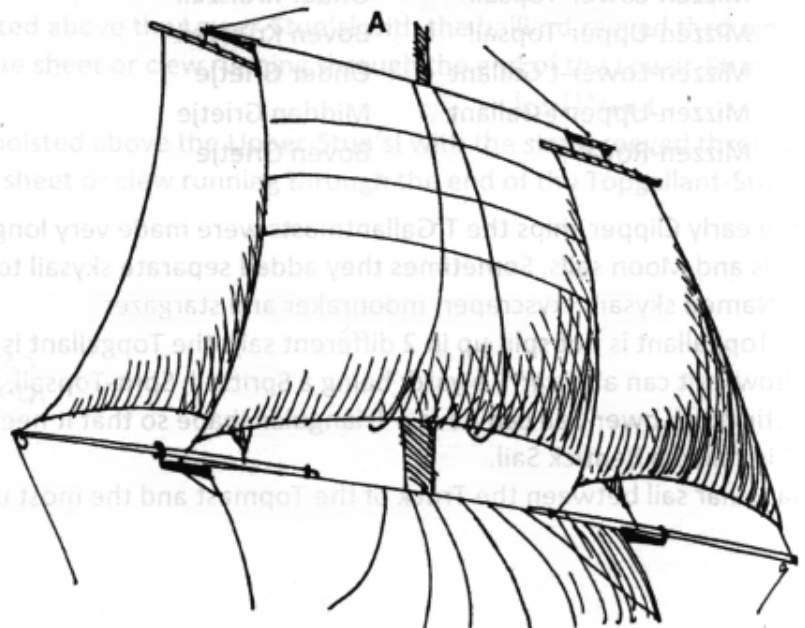
- Klauwhoek
- Piek of Nok
- Schoothoek
- Halshoek



3. Studdingsails (Lijzeilen)

→ staan aan windward
however!!

Studdingsails or Stun'sls are carried besides the normal square-sails. Stun'sls are light weather sails and are set flying from the deck. They are made of light canvass and have no boltropes. The meaning of the word studding sails is lost in history. In general they are set to windward but when sailing downwind they can be set on both sides. The Fore and Main-yard are lengthened by the lower- studdingsail-booms (Onder-Lijzeilspieren). The Fore and Main-Uppertopsail-yards are lengthened by the upper-studdingsail-booms (Boven-Lijzeilspieren). On the sides of the foremast on the rail on both sides is the Swinging-boom or Passaree-boom (Bakspier). This boom is stretching out the sail by the Lower-Studdingsail-Clewline (or outer Sheet). Stun'sls are hoisted with halliards which are connected to the stun'sl-yards which are bent to the heads of the Sails. On the foot of the sail are one or two clew lines (sheets) often called the inner & outer clew line or sheet and one buntline.



Names of the Sails

The square sails are named after the yard which they are bent on to, which is named after the topmast it is connected to and this one is named after the top it is part of.

Staysails are named after the topmast or lower mast where their stay is running to.

There is a system in all these names that are part of the total rigging of a square rigger, **but.....**there are always exceptions to these rules and individual ships have exceptions on these general rules.

Square Sails:

Fore Top

- Fore course
- Fore-Lower-Topsail
- Fore-Upper-Topsail
- Fore-Lower-Topgallant
- Fore-Upper-Topgallant
- Fore-Royal
- Fore-Skysail

Fokkemast, Voor-top

- Fok
- Voor-Onder-Mars
- Voor-Boven-Mars
- Voor-Onder-Bram
- Voor-Midden-Bram
- Voor-Boven-Bram
- Voor-Scheizeil

Main Top

- Maincourse (sail)
- Main-Lower-Topsail
- Main-Upper-Topsail
- Main-Lower-Topgallant
- Main-Upper-Topgallant
- Main-Royal
- Main-Skysail
- Main-Moonsail

Grote-top

- Grootzeil
- Groot-Onder-Mars
- Groot-Boven-Mars
- Groot-Onder-Bram
- Groot-Midden-Bram
- Groot-Boven-Bram
- Groot-Schij-Zeil
- Klapmuts

Mizzen Top

- Crossjack, Cro'jack
- Mizzen-Lower-Topsail
- Mizzen-Upper-Topsail
- Mizzen-Lower-t'Gallant
- Mizzen-Upper-t'Gallant
- Mizzen-Royal

Kruis-top

- Begijn, Bagijn
- Onder Kruiszeil
- Boven Kruiszeil
- Onder Grietje
- Midden Grietje
- Boven Grietje

→ topsails are
now in position
the main sail
is the 1st of 3
- main in the shadow of
- now in position for
- now in position for

On the early Clipper ships the T'Gallantmasts were made very long so that they could carry more sails like skysails and Moon sails. Sometimes they added separate skysail topmasts. They added more and more sails. Named skysail, skyscraper, moonraker and stargazer.

If the Topgallant is not split up in 2 different sails the Topgallant is hoisted.

The bowsprit can also carry a yard; being a Spritsail, Sprit-Topsail, Jimmy Green.

Sometimes a Lower-Sail can have a Triangular shape so that it needs just one sheet in the amidships. Such a sail is called a Bentick Sail.

A triangular sail between the Truck of the Topmast and the most upper yard arm is called a Raffee.

Staysails

s They receive the names from the topmast were they are hoisted to.

Fore Top

- Flying Jib
- Outer Jib
- Inner Jib
- Fore-Topmast-Staysail

Fokkemast, Voortop

- Jager
- Buiten Kluiver
- Binnen Kluiver
- Voor-Stenge-Stagzeil

Main Top

- Main-Topmast-Staysail
- Main-Topgallant-Staysail
- Main-Royal-Staysail

Grote Top

- Groot-Stenge-Stagzeil, Dekzwabber
- Groot-Bramstenge-stagzeil
- Groot-Boven-Bramstenge-stagzeil

Mizzen, Ship rigged

- Mizzen-Staysail
- Mizzen-Topmast-staysail
- Mizzen-Topgallant-staysail

Kruismast, Volschip

- Kruis-stagzeil
- Kruis-Stenge-stagzeil
- Vlieger

Mizzen, Barque

- Mizzen-Staysail
- Mizzen top-Staysail
- Mizzen topgallant-Staysail

Bezaanmast, Bark

- Aap
- Bezaantop-stagzeil
- Vlieger

Gaff sails

- Spanker, Driver on the mizzenmast. (Bezaan of Spanker).
- Spencer, on the main or foremast (Barkzeil).

Studdingsails (Lijzeilen)

- **Lower-Stun'sl, (Onderlijzeil);** hoisted on the Lower-Stun'sl-boom, sheet or clew going to the Passaree or Swinging boom.
- **Upper-Stun'sl, (Bovenlijzeil);** hoisted above the Lower-Stun'sl with the halliard reeved through the end of the Top-Gallant-yard and the sheet or clew running through the end of the Lower-Stun'sl boom.
- **Topgallant-Stun'sl, (Bramlijzeil);** hoisted above the Upper-Stun'sl with the ~~sheet~~ ^{halliard} reeved through the end of the Royal-yard and the sheet or clew running through the end of the Topgallant-Stun'sl-boom.

Zeeg = sheet
en

4.3 Running Rigging

All the lines that we use to hoist and trim the yards and the sails we call the **Running Rigging (Lopend Want)**. Through the structure of the rig it is almost obvious that lines serving certain yards or sails are running the same way through the rig on different ships. This makes it a lot easier for the sailor if he enters the deck of any square rigger in the world. Certain lines are always ending up on the same belaying-pin on deck. Understanding why that is the case is something that you have to learn from both books and in practice.

We divide the running rigging into 3 groups and have a closer look at them in the following chapters.

1. **Lines to hoist and brace the yards in different directions.**
2. **Lines to adjust and trim the square sails.**
3. **Lines connected to the fore & aft sails.**

1. **To hoist and brace the yards we have:**
 - Toppinglifts (Toppenenden)
 - Halliards (Vallen)
 - Downhaul (Neerhaler)
 - Braces (Brassen)

Topping-lift (Toppenend).

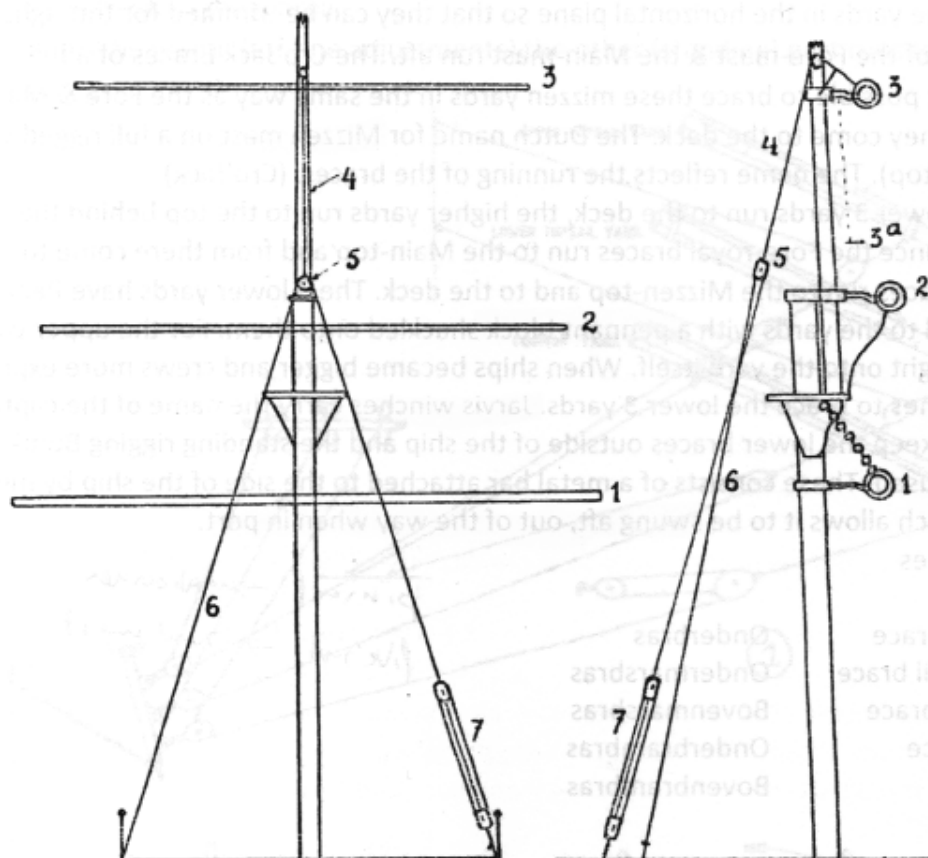
These lines support or move the yard in the vertical plane. Toppinglifts are connected to the end of the yardarm and running to the (top) mast and support the yard in the lower position (when the sail is not set). When the yard is "in its topping-lifts" it sits perfectly horizontal and steady so the crew can work on them without any danger. When the yard is hoisted because the sail is set, the topping-lifts become slack and hang in a bight and are not of any use.

These kind of topping-lifts you will find on all the yards that have to be hoisted for setting the sail and they are wires with a fixed length shackled on to the yard and the (top) mast.

The lower yards also have topping-lifts but they are running from the yard arm to a single block on the mast and then connected to a jigger that runs along the lower mast down to the deck. The lower yards are fixed yards so these topping-lifts are for adjusting the lower yards in the vertical plane. By adjusting these yards while sailing all the yards above (with set sails) are following this adjustment. In this way we can bring the yards horizontal even when the ship is heeling over when sailing close-hauled. In some occasions the lower yards sticking outside the hull are a problem. You can think of going alongside another (tall) ship, entering locks or while discharging cargo. With the topping-lift one of the yardarms can be brought all the way to the deck and inboard while the other yardarm is pointing into the sky. The other higher yards are then braced sharp around on the other tack. This manoeuvre is called to **Cockbill (Kaaïen)**.

Halliard (Val)

To hoist and lower the running yards, they need a Halliard. The Halliard is a combination of different parts. The first one is called the Tye (Draaireep) and is connected to the yard itself and runs over a sheave through the mast and is shackled to a Gin-block on the aft-side of the mast. In general this Tye is made out of steel-wire or chain. Then there is a wire running from one side of the deck up to the Gin-block (Standing Part) and comes down to the other side of the deck where it is connected to a Purchase or a Halliard winch. In Dutch this wire is called the "Mantel". In English the wire and the purchase tackle are both commonly called the Halliard however if the two need to be distinguished, the wire is called a whip. Through this way of rigging the Halliard, the Gin-block always stays amidships and so the tension is on the Tye. So beside the equal pull on the Tye this double Halliard also gives the additional mechanical advantage of a whip.



from aft

View from the SB side

View

Schematic view from the Upper-topsail halliard with Tye, standing halliard, running halliard and purchase. (Boven-Marsval met Draaireep, Mantel en val)

1. Lower Yard (fixed)
2. Lower Topsail Yard (fixed)
3. Upper Topsail Yard (running)
- 3a. Lower position Upper Topsail Yard
4. Tye
5. Gin block
6. Halliard (standing part)
7. Upper Topsail purchase (or Halliard)

- Onder ra (vaste ra)
- Ondermarse ra (vaste ra)
- Bovenmars ra (strijkende ra)
- Gestreken positie Bovenmars ra
- Draaireep
- Mantelblok
- Mantel
- Bovenmars val

Downhaul (Neerhaler).

The Lower topsail-yard does not have a Topping-lift because when the Uppertopsail-yard is in its lower position (no sail set) it would be in the way of those wires. Instead the Lower topsail-yard is supported by the Downhauls of the Uppertopsail-yard. They run from the Lower topsail-yard arm to a block on the end of the Uppertopsail-yard arm and then along the yardarm to a block on the yard along the mast to the deck. When striking the Uppertopsail-yard you pull the Downhaul tight, when the Uppertopsail-yard is resting in its topping-lifts you belay them properly. Through this construction the Lower topsail-yard is secured in a horizontal position and crew can enter the yard. Always make sure that these Uppertopsail-yard downhauls are belayed securely. The safety of the crew on the yard is dependent on that. On some ships these pins are marked differently from the others to prevent mistakes.

409 401 666 03 69

Brace (Bras)

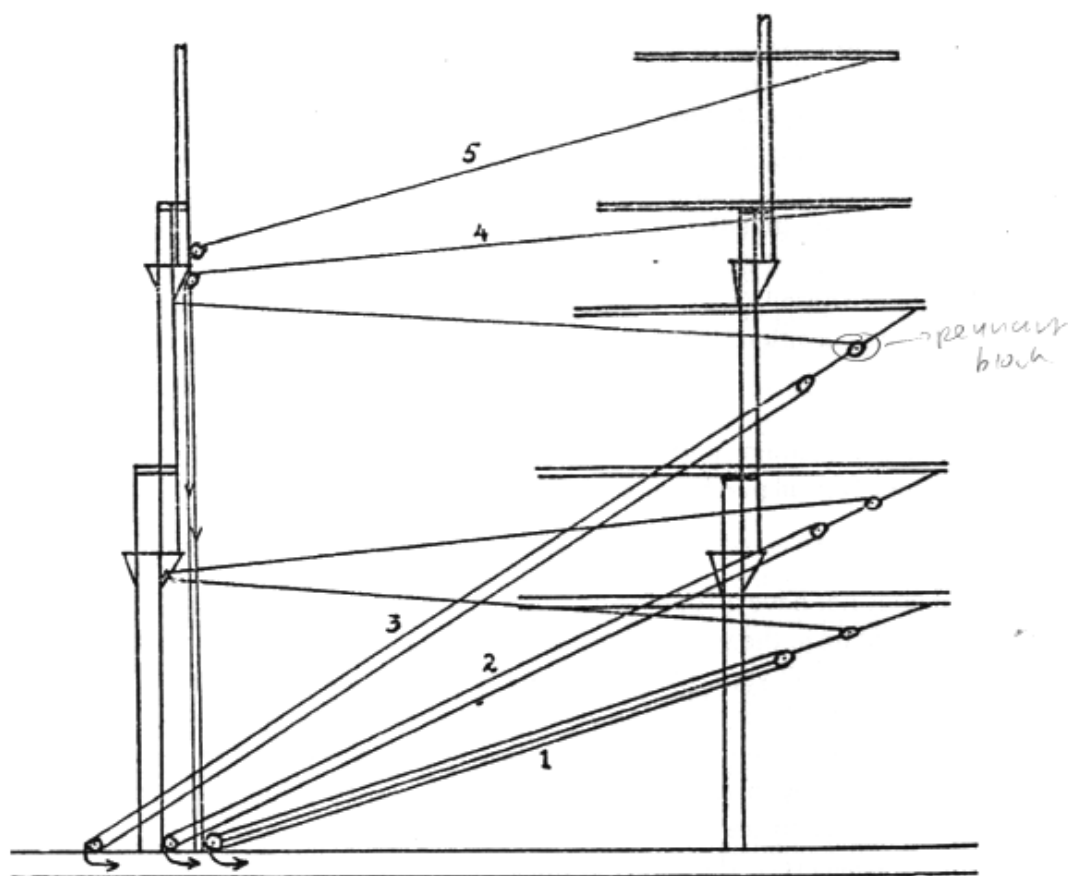
The Braces move the yards in the horizontal plane so that they can be trimmed for the right wind and course. The Braces of the Fore-mast & the Main-mast run aft. The Cro'Jack Braces of a full rigged ship run forward. To make it possible to brace these mizzen yards in the same way as the Fore & Main they often cross-over before they come to the deck. The Dutch name for Mizzen mast on a full rigged vessel is "Kruismast" (Cross top). The name reflects the running of the braces. (Cro'Jack)

The braces of the lower 3 yards run to the deck, the higher yards run to the top behind the one they are bracing. So for instance the Fore-royal braces run to the Main-top and from there come to deck and the Main-Topgallant braces run to the Mizzen-top and to the deck. The 3 lower yards have Pennants (Bras schinkel) connected to the yards with a pennant block shackled onto them. For the upper yards the braces are connected straight onto the yard itself. When ships became bigger and crews more expensive they started to use winches to brace the lower 3 yards. Jarvis winches carry the name of the captain that designed them. To keep the lower braces outside of the ship and the standing rigging Bumkins (Brasbomen) were used. These consists of a metal bar attached to the side of the ship by means of a hinged bracket, which allows it to be swung aft, out of the way when in port.

The run of the braces

- | | |
|-------------------------|---------------|
| 1 = Lower-yard brace | Onderbras |
| 2 = Lower-topsail brace | Ondermarsbras |
| 3 Upper-topsail brace | Bovenmarsbras |
| 4 Topgallant brace | Onderbrambras |
| 5 Royal brace | Bovenbrambras |

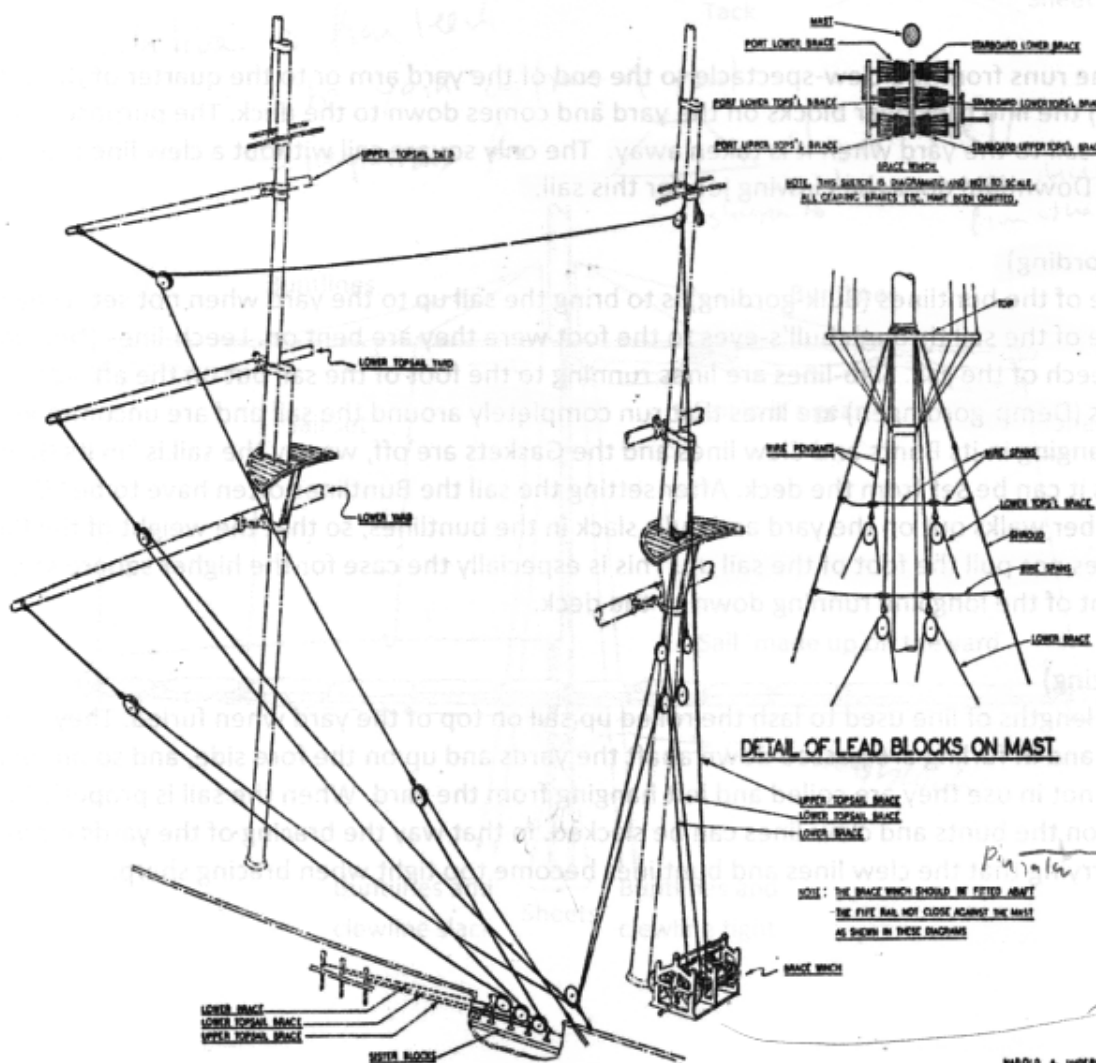
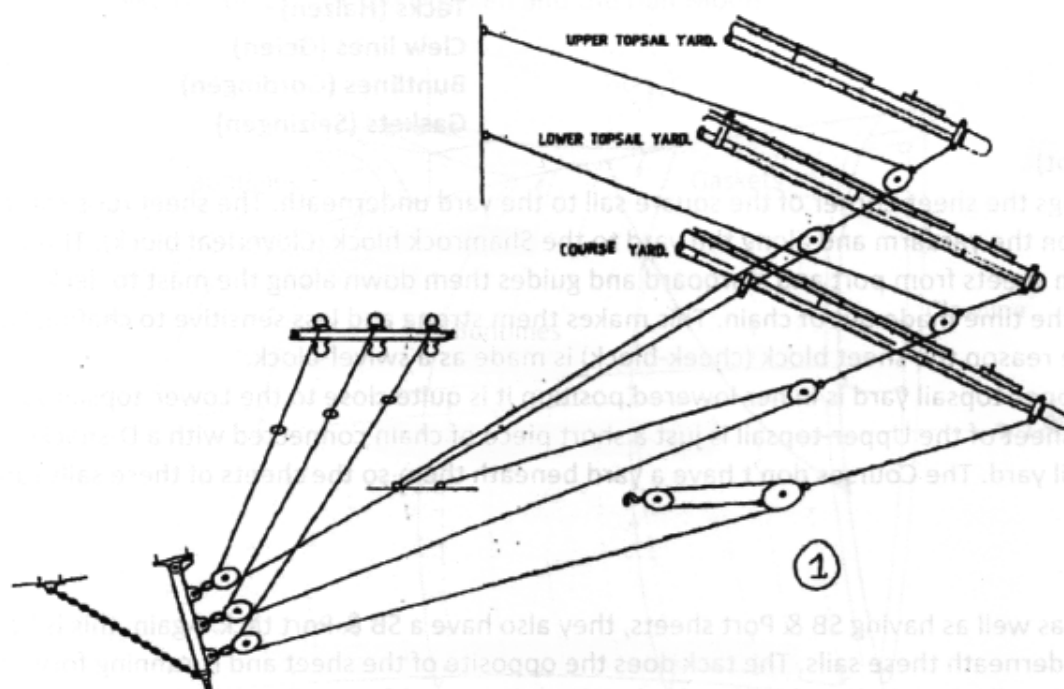
*pinnail → mainboarder
file rail → main mast*



Two possibilities to run the lower 3 braces, with or without Jarvis winches.

1) Straight from the Bumkin to the pinrail.

2) From the Bumkin to the pinrail (for fine adjustments) the other (standing) part runs to the Jarvis winches



2. Lines to adjust and trim the square sails

To adjust and handle the Square sails we need:

Sheets (Schoten)
Tacks (Halzen)
Clew lines (Geien)
Buntlines (Gordingen)
Gaskets (Seizingen)

Sheet (Schoot)

This line brings the sheet-corner of the square sail to the yard underneath. The sheet runs through the sheet block on the yardarm and along the yard to the Shamrock block (Cloverleaf block). This block receives both sheets from port and starboard and guides them down along the mast to deck. The sheets are most of the time made out of chain. This makes them strong and less sensitive to chafing (schavielen). For the same reason the sheet block (cheek-block) is made as a swivel-block.

When the Upper-topsail yard is in her lowered position it is quite close to the Lower-topsail yard. In general the sheet of the Upper-topsail is just a short piece of chain connected with a D-shackle to the Lower-topsail yard. The Courses don't have a yard beneath them so the sheets of these sails run aft to the main deck.

Tack (Hals)

The Courses as well as having SB & Port sheets, they also have a SB & Port tack. Again, this is because there is no yard underneath these sails. The tack does the opposite of the sheet and is running forward to the deck. The tack pulls the windward spectacle clew-iron down and forward.

Clew (Gei)

The Clew-line runs from the clew-spectacle to the end of the yard arm or to the quarter of the yard arm (old fashion) the line runs over blocks on the yard and comes down to the deck. The purpose of this line is to bring the sail to the yard when it is taken away. The only square sail without a clew line is the Upper-Topsail; the Downhaul does the clewing job for this sail.

Buntline (Gording)

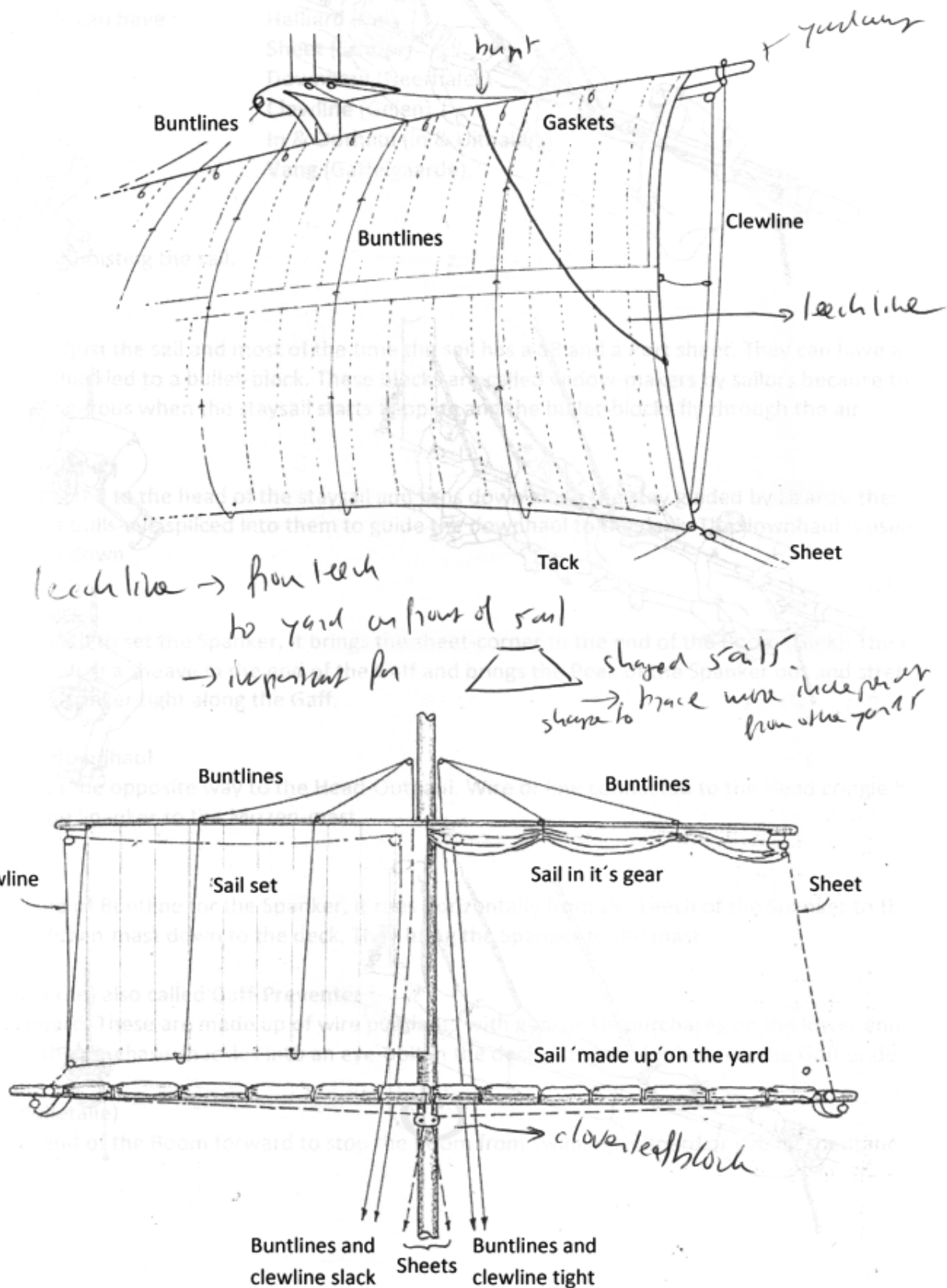
The purpose of the buntlines (Buik-gording) is to bring the sail up to the yard when not set. They run on the forward side of the sail through bull's-eyes to the foot where they are bent on. Leech-lines (Nok-gording) run to the leech of the sail. Slab-lines are lines running to the foot of the sail but on the aft side of the sail. Spilling-lines (Demp-gordingen) are lines that run completely around the sail and are uncommon. When a sail is just hanging in its Bunts and Clew lines and the Gaskets are off, we say the sail is "in its Gear". In other words it can be set from the deck. After setting the sail the Buntlines often have to be "Overhauled". A crewmember walks out on the yard and pulls slack in the buntlines, so that the weight of the Buntline to the deck does not pull the foot of the sail up. This is especially the case for the higher square sails because of the weight of the long line running down to the deck.

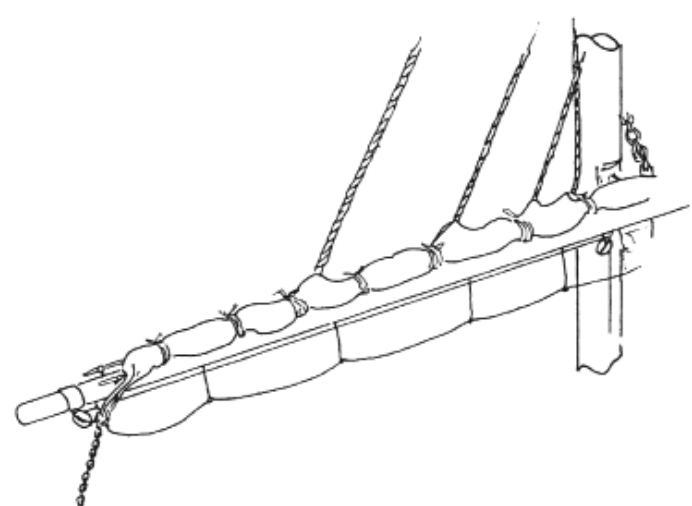
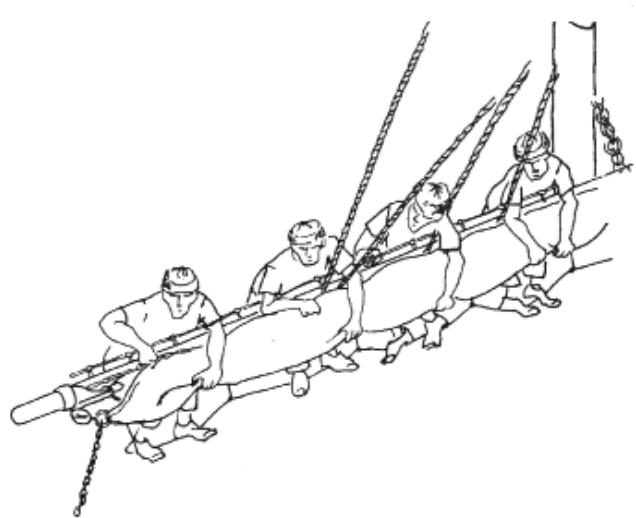
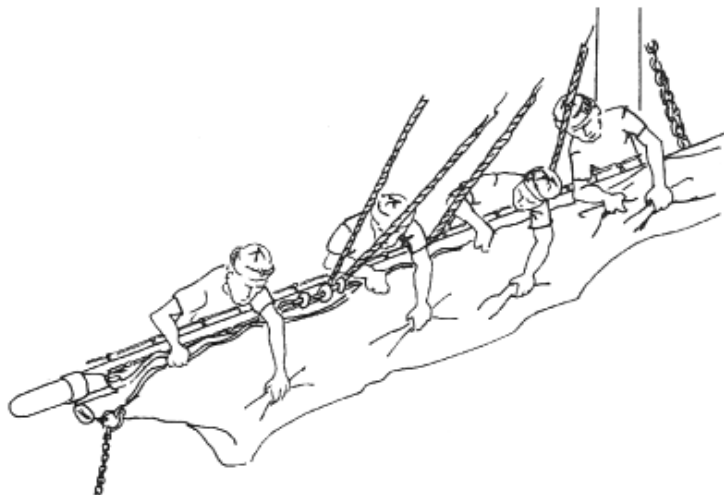
Gasket (Seizing)

Gaskets are lengths of line used to lash the rolled up sail on top of the yard when furled. They are attached to the yard, and in furling are passed down abaft the yards and up on the fore side, and so on round the yard. When not in use they are coiled and left hanging from the yard. When the sail is properly furled with the gaskets on, the bunts and clew-lines can be slacked. In that way the bracing of the yards is possible without worrying that the clew lines and buntlines become too tight when bracing sharp.

Bowline (Boeilijn)

When a square sail has a long standing leech it is in need of a Bowline which is connected to that leech and runs forward, in that way it keeps the leech tight when sailing close hauled. (Old fashioned). You will find bowlines on replicas like the Batavia or the Duyfken and the Half Moon.





Stowing Square sails

3.
Fo
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3. Lines connected to the fore & aft sails

Fore and Aft Sails can have :

Halliard (Val)
Sheet (Schoot)
Downhaul (Neerhaler)
Clewline (Geien)
In & Outhaul (in & Uithalers)
Vang (Gaffelgaarde).

Halliard (Val)

The Halliard is for hoisting the sail.

Sheet (Schoot)

The Sheet is to adjust the sail and most of the time the sail has a SB and a Port sheet. They can have a pennant that is shackled to a bullet-block. These blocks are called widow-makers by sailors because they become very dangerous when the staysail starts flapping and the bullet-blocks fly through the air.

Downhaul (Neerhaler)

This line is connected to the head of the staysail and runs down along the stay guided by Lizards, these are small lines with a bulls-eye spliced into them to guide the downhaul to the deck. The downhaul is used to bring the staysail down.

Outhaul (Uithaler)

The Outhaul is used to set the Spanker, it brings the sheet-corner to the end of the Boom (Giek). The Peak-outhaul runs through a sheave in the end of the Gaff and brings the Peak of the Spanker out and stretches the head of the Spanker tight along the Gaff.

Head-inhaul or downhaul

This line works in the opposite way to the Head-Outhaul. Wire or line connected to the Head cringle brings in the head of the Spanker to the Mizzen-mast.

Brail

The Brail is a kind of Buntline for the Spanker, it runs horizontally from the Leech of the Spanker to the lead blocks on the Mizzen-mast down to the deck. They bring the Spanker to the mast.

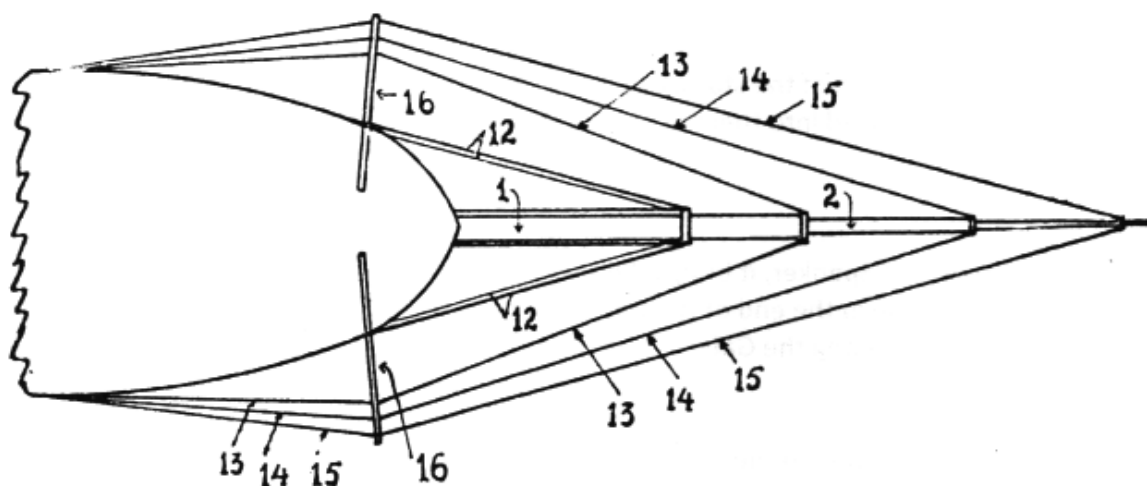
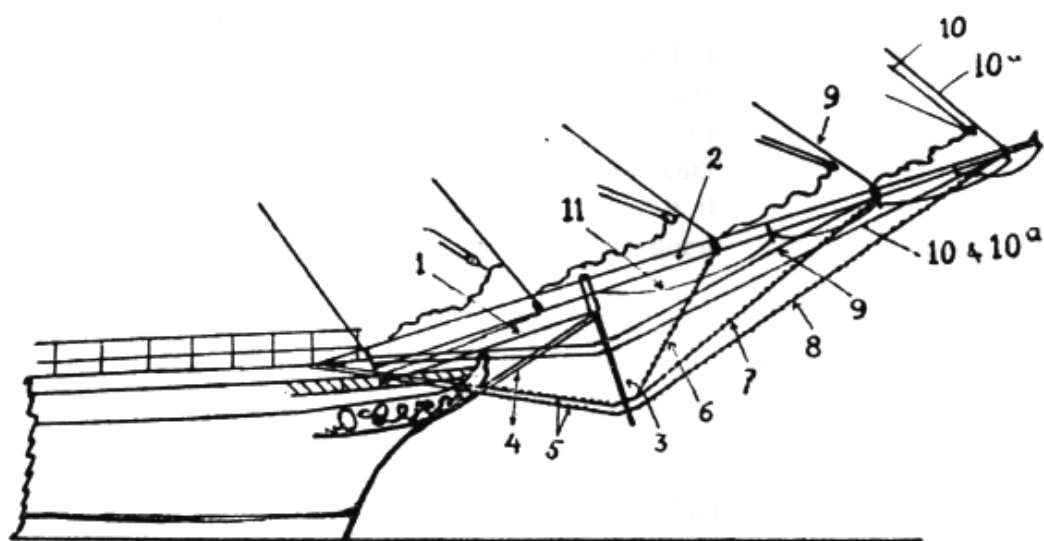
Vang (Gaffelgeerde) also called Gaff-Preventer

Port and Starboard. These are made up of wire pendants with gun-tackle purchases on the lower ends, the lower block of the purchase shackles into an eye-bolt in the deck. They are for keeping the Gaff under control.

Boom stop (Buletalie)

Runs from the end of the Boom forward to stop the Boom from swinging inboard or gybing spontaneously.

The rigging of the Bowsprit & Jibboom



1. Boegspriet
2. Kluiverboom
3. Spaansche ruiter of stampstok
4. Waterstag
5. Achteruithouders
6. Kluiverstampstag
7. Buitenkluiverstampstag
8. Snavelstag
9. Kluiverstag
10. Buitenkluiverstag
- 10a Voorbovenbramstag
11. Paarden
12. Boegstagen
13. Kluivergeien
14. Buitenkluivergeien
15. Jaaghoutgeien
16. Voelhoorns

- Bowsprit
- Jibboom
- Martingale or dolphin-striker
- Bobstay
- Martingale backstay or martingale guys
- Inner martingale stay or inner jib-boomstay
- Outermartingale stay or outer jib-boomstay
- Flying martingale stay or flying jib-boomstay
- Outerjibstay
- Flying jibstay
- Fore royal stay
- Footropes
- Bowsprit guys
- Inner jib-boom guy
- Outer jib-boom guy
- Flying jib-boom guy
- Whisker booms

*in the
absence
stampstag*

working stay

*→ connected
on top of cuthead*

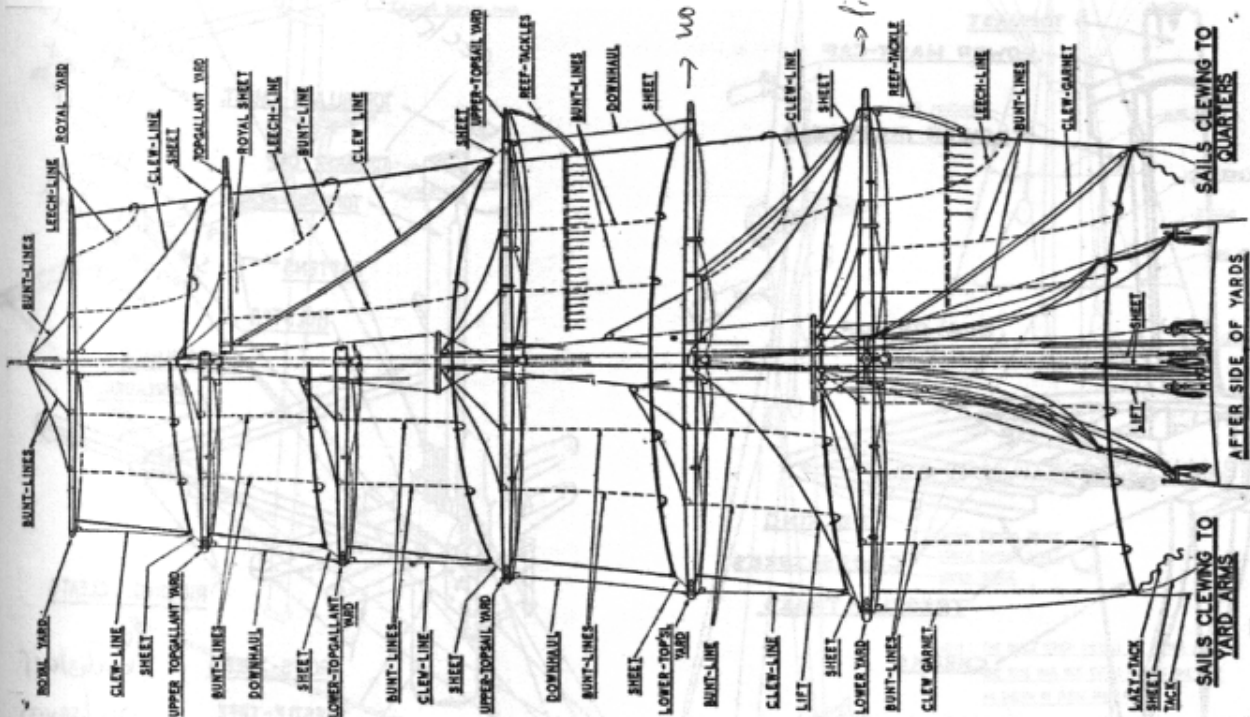
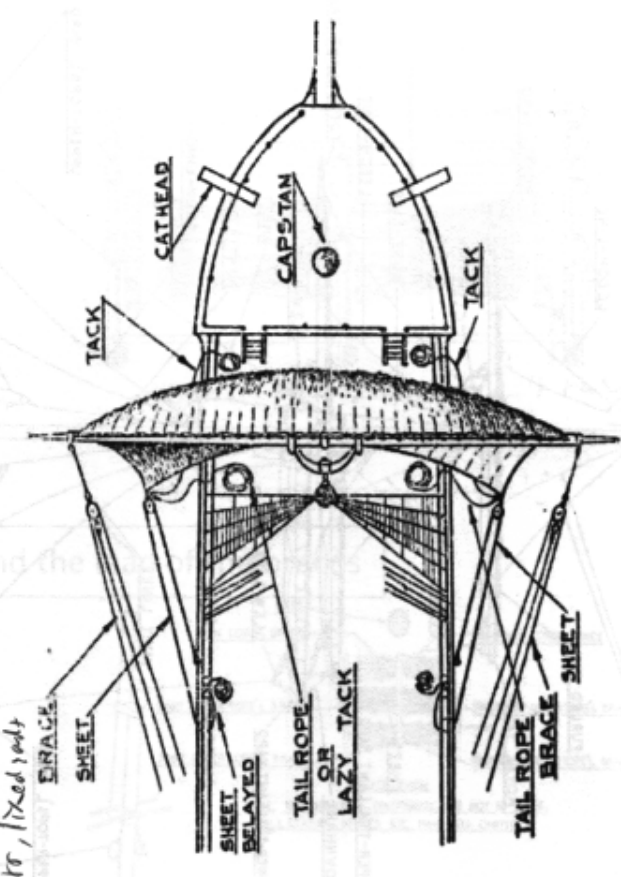
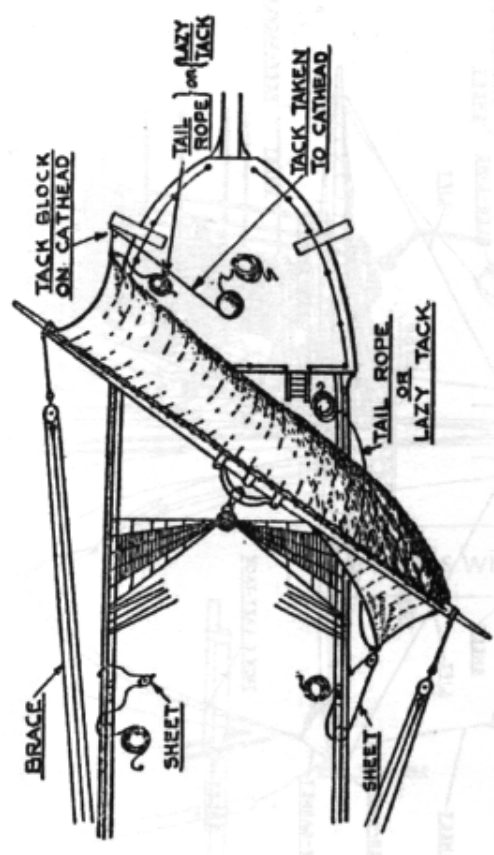


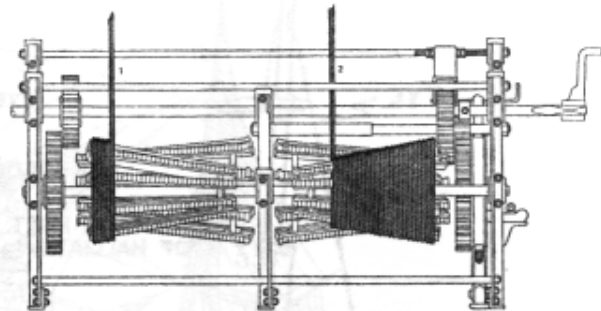
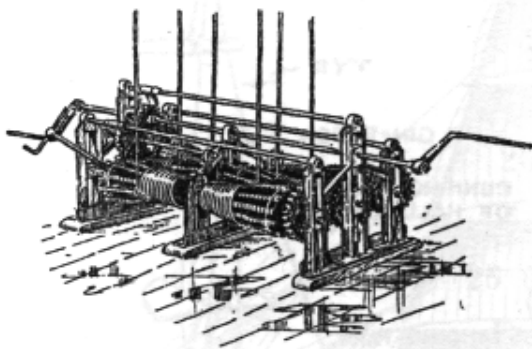
PLATE No. 34.—RUNNING RIGGING ON SQUARE SAILS.
(Sails Set.)

modern

classical

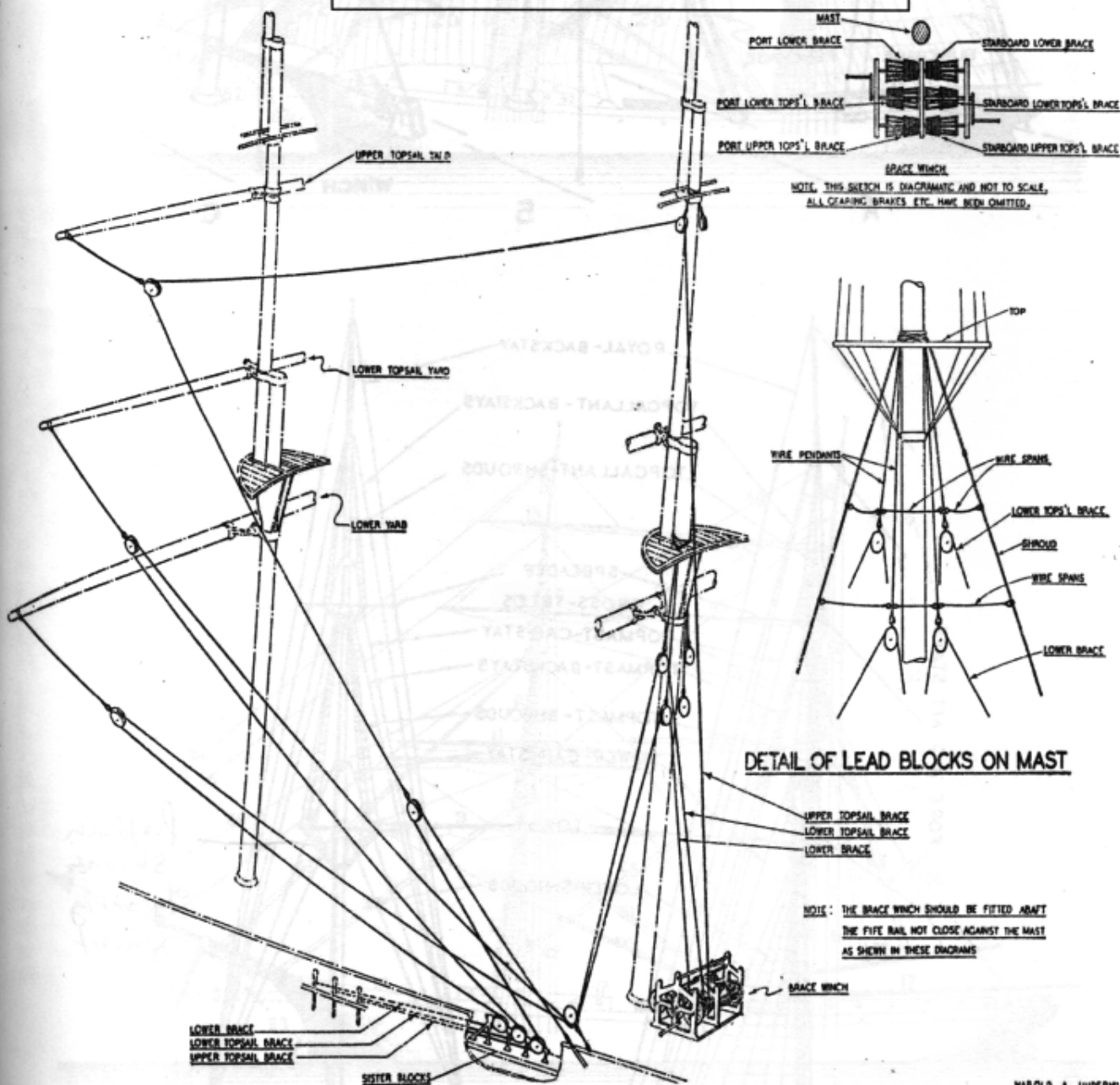


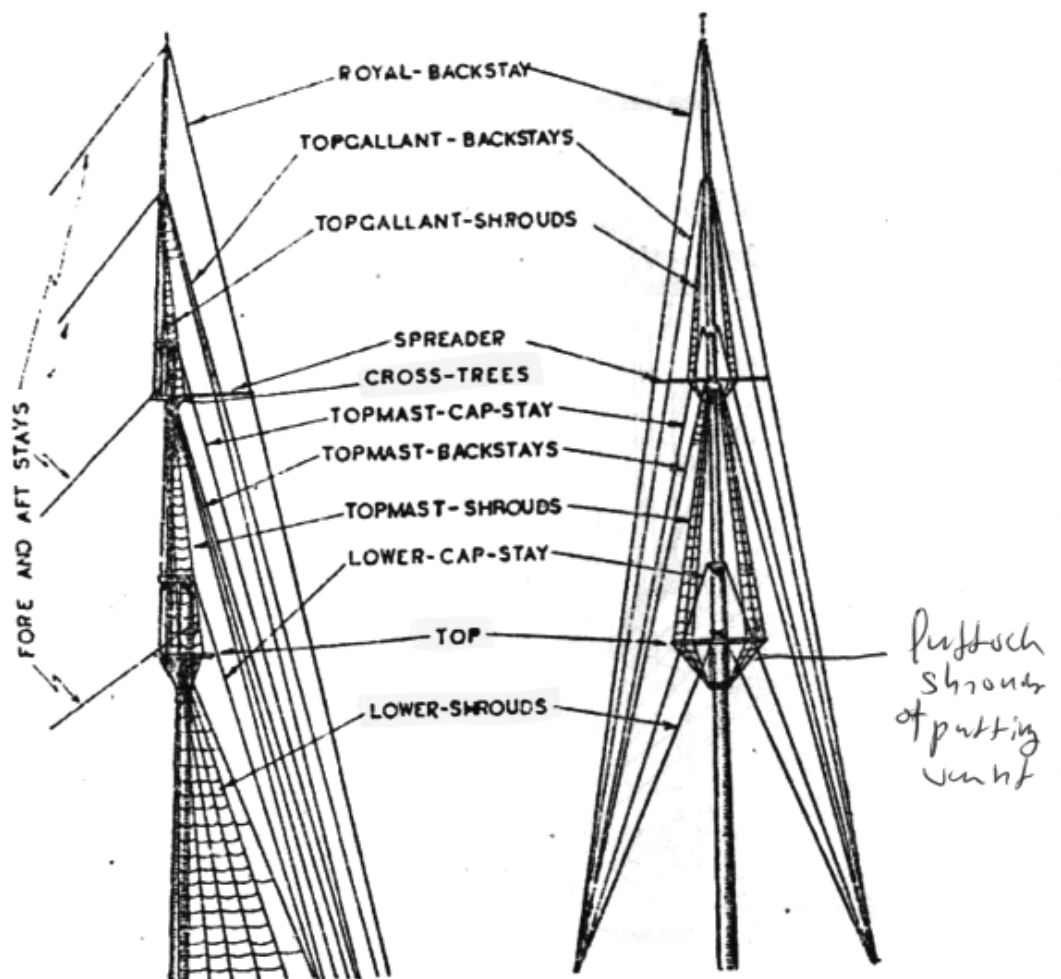
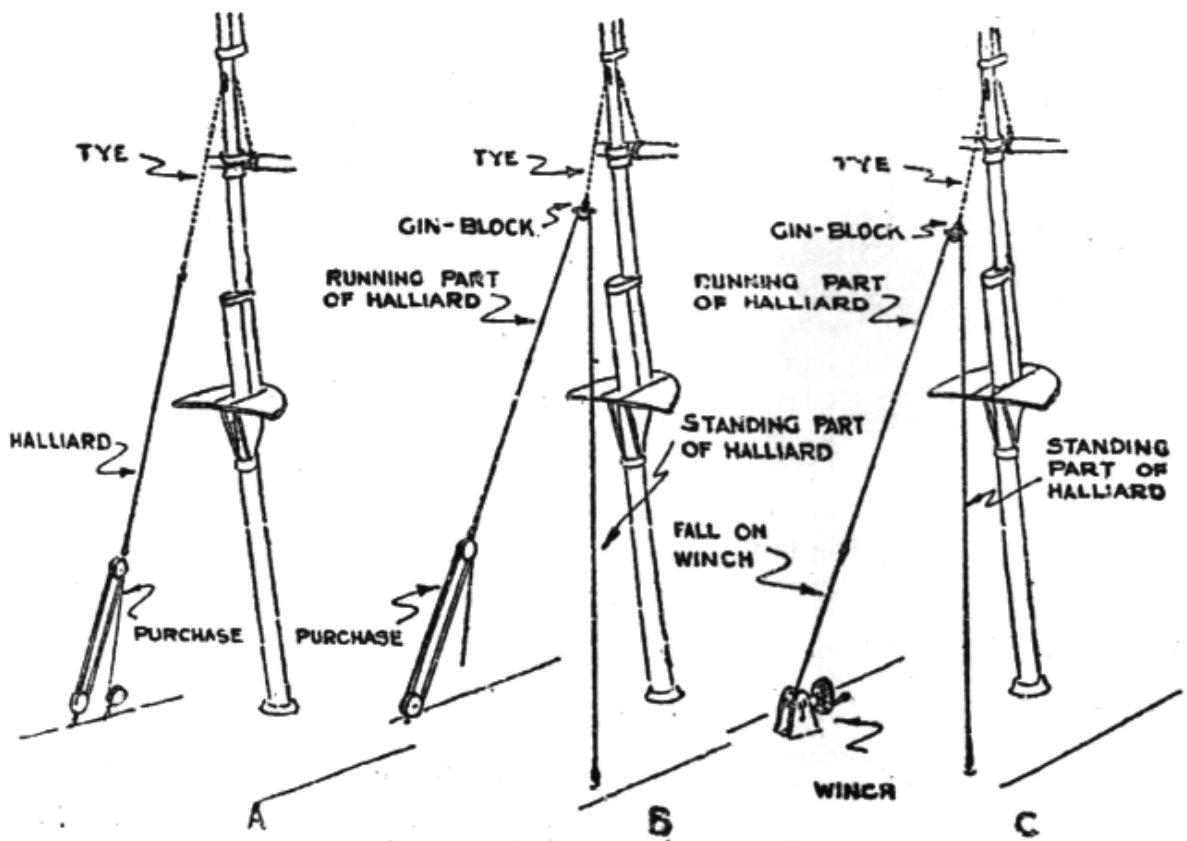
backboard-hur = stern shroud boom

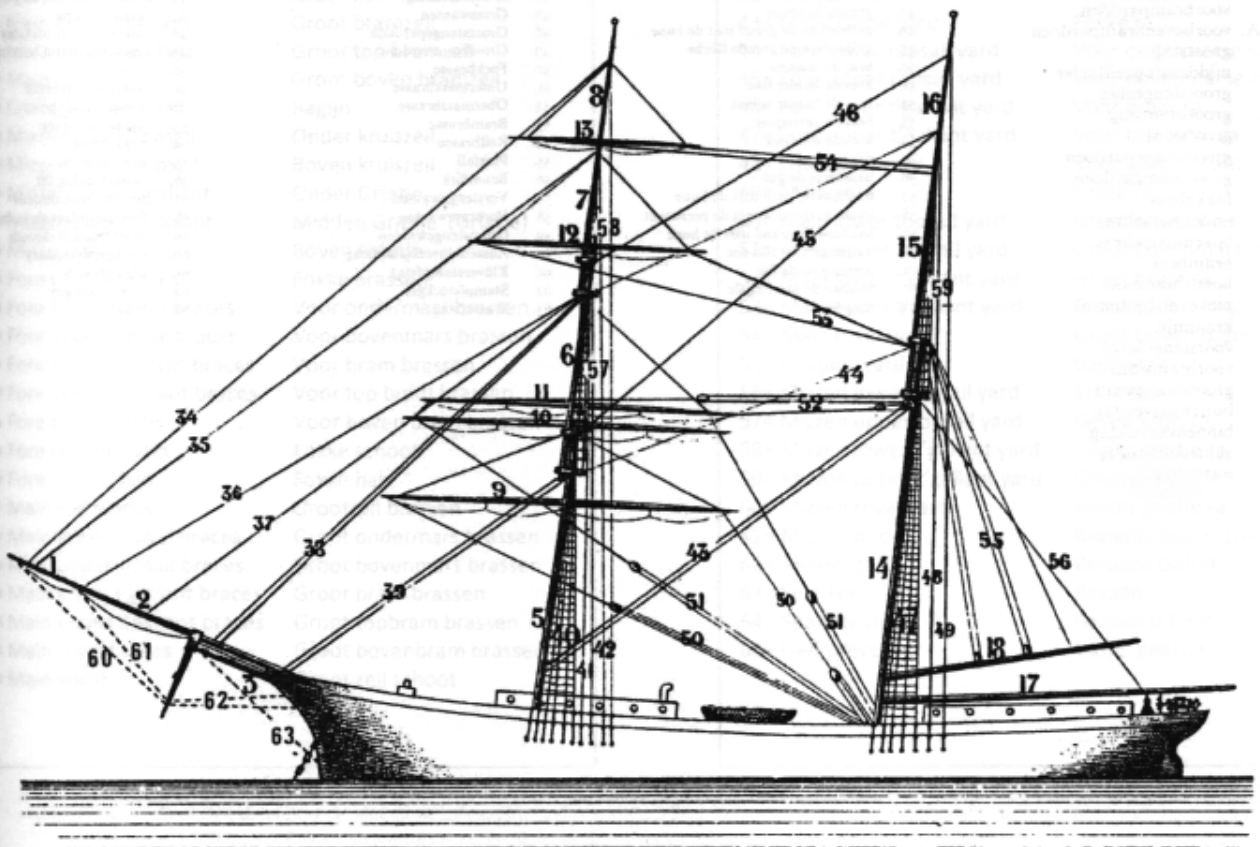
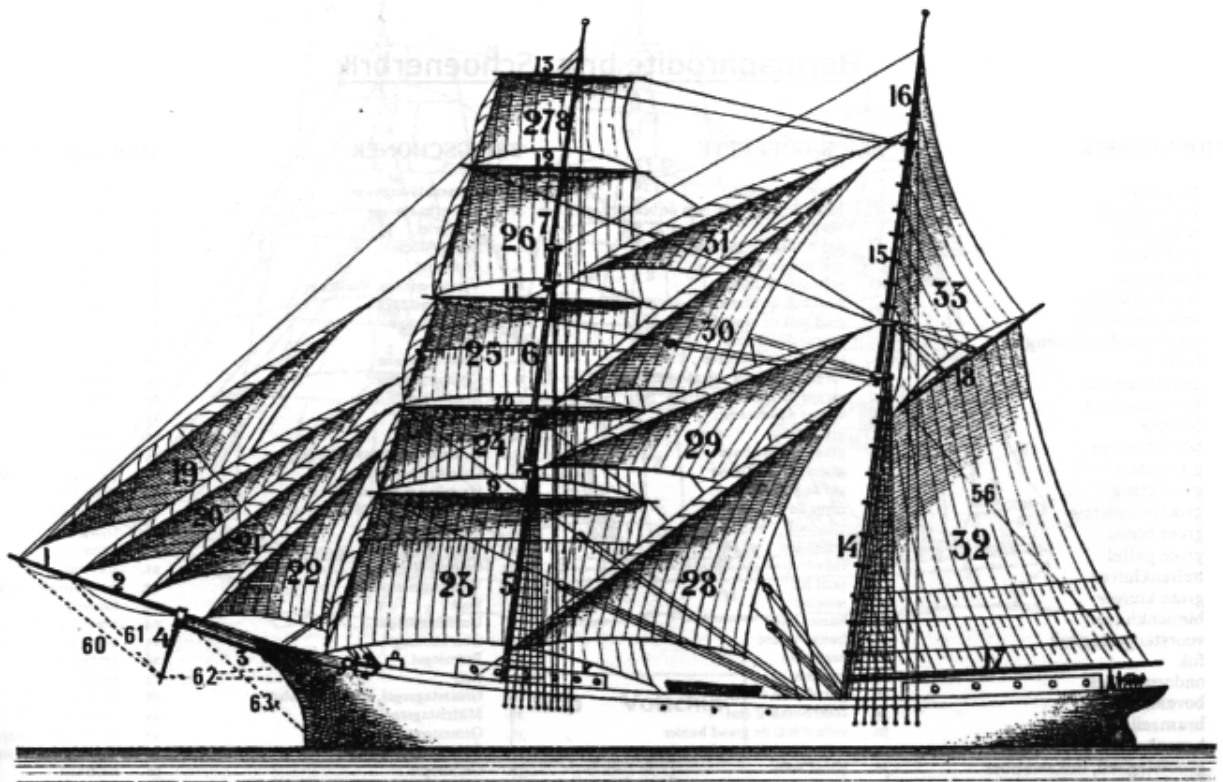


conical beca you don't take in
the same speed or give out
→ hugges on yonder!!

The Jarvis winch and the lead of the braces







Hermaphrodite brig Schoenerbrik

SCHOENERBRIK

1. jaaghout
2. kluiverboom
3. boegspriet
4. stampstok
5. fokkemast
6. voormarssteng
7. voorbramsteng
8. voorbovenbramsteng
9. fokkera
10. ondermarsera
11. bovenmarsera
12. bramra
13. bovenbramra
14. grote mast
15. grote steng
16. grootbramsteng
17. grote boom
18. grote gaffel
19. buitenkluiwer
20. grote kluiwer
21. binnenkluiwer
22. voorstengestagzeil
23. fok
24. ondermarszeil
25. bovenmarszeil
26. bramzeil
27. bovenbramzeil
28. grootstagzeil, dekzwabber
29. middenstagzeil, vlieger
30. grootstengestagzeil
31. grootbramstagzeil
32. grootzeil
33. gaffeltopzeil
34. voorbovenbramstag
35. voorbramstag
36. kluiverleider
37. binnenkluiwerleider
38. voorstengestag
39. fokkestag
40. fokkewant
41. voorstengepardoen
42. voorbrampardoen
- 42A. voorbovenbrampardoen
43. grootstag
44. middenstagzeilleider
45. grootstengestag
46. grootbramstag
47. grootwant
48. grootstengepardoen
49. grootbrampardoen
50. fokkebras
51. ondermarsbras
52. bovenmarsbras
53. brambras
54. bovenbrambras
55. piekeval, buitenval
56. kraanlijn
57. voorstengewant
58. voorbramwant
59. grootstengewant
60. buitensnavelstag
61. binnensnavelstag
62. achteruithouder
63. waterstag

BRICK-GOËLETTE

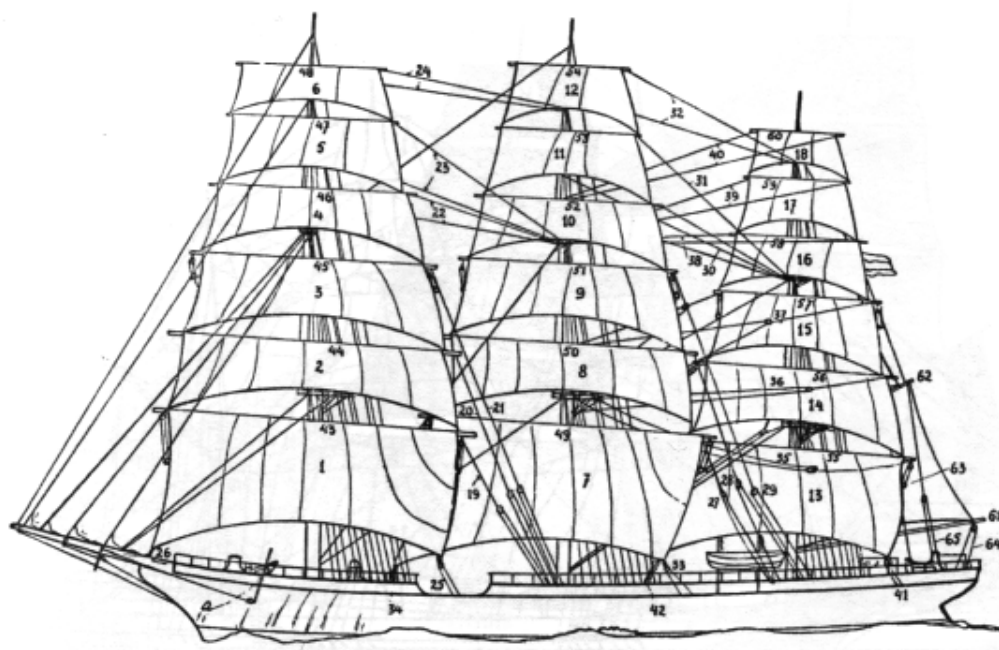
1. bâton de clin-foc
2. bâton de foc, boute-hors de beauprè
3. beauprè
4. arc-boutant de martingale
5. mât de misaine
6. petit mât de hune
7. petit mât de perroquet
8. petit mât de cacatois
9. vergue de misaine
10. vergue de hunier fixe
11. vergue de hunier volant
12. vergue de perroquet
13. vergue de cacatois
14. grand mât
15. grand mât de hune
16. grand mât de flèche
17. gui de grand voile
18. corne de grand voile
19. clin-foc
20. grand foc
21. faux-foc
22. petit foc
23. misaine
24. hunier fixe
25. hunier volant
26. perroquet
27. cacatois
28. grand voile d'étai
29. contre-voile d'étai
30. voile d'étai de grand hunier
31. voile d'étai de grand perroquet
32. grand voile
33. flèche-en-cul
34. étai de petit mât de cacatois
35. étai de petit mât de perroquet
36. draille de grand foc
37. draille de faux-foc
38. étai de petit mât de hune
39. étai de mât de misaine
40. haubans de misaine
41. galhauban de petit mât de hune
42. galhauban de petit mât de perroquet
- 42A. galhauban de petit mât de cacatois
43. grand étai
44. draille de contre-voile d'étai
45. étai de grande mât de hune
46. étai de grande flèche
47. grands haubans
48. galhauban de grand mât de hune
49. galhauban de grande flèche
50. bras de misaine
51. bras de hunier fixe
52. bras de hunier volant
53. bras de perroquet
54. bras de cacatois
55. drisse de pic
56. balancine de gui
57. haubans de petit mât de hune
58. haubans de petit mât de perroquet
59. haubans de grand mât de hune
60. martingale de clin-foc
61. martingale de foc
62. hauban de martingale
63. sous-barbe

BRIGGSCHONER

1. Aussenklüverbaum
2. Klüverbaum
3. Bugspruit
4. Stampfstock
5. Fockmast
6. Voormarsstenge, Vorstenge
7. Vorbramstenge
8. Vorroilstenge
9. Fockrahe
10. Untermarsrahe
11. Obermarsrahe
12. Bramrahe
13. Rollrahe
14. Grossmast
15. Groszstenge, grosse Sienge
16. Grossbramstenge
17. Grossbaum, grosser Baum
18. Grossgaffel, grosse Gaffel
19. Aussenklüver
20. Grosser Klüver
21. Binnenklüver
22. Vorstengestagsel
23. Fock
24. Untermarssegel
25. Obermarssegel
26. Bramsegel
27. Roil
28. Groszstagsel, Deckschwabber
29. Mittelstagsel, Flieger
30. Groszstengestagsel
31. Grossbramstagsel
32. Groszsegel
33. Gaffeltoppsel
34. Vorroilstag
35. Vorbramstag
36. Klüverleiter
37. Binnenklüverleiter
38. Vorstengestag
39. Fockstag
40. Fockwanten
41. Vorstengepardune
42. Vorbrampardune
- 42A. Vorroilpardune
43. Groszstag
44. Mittelstagselgelleiter
45. Groszstengestag
46. Grossbramstag
47. Grosswanten
48. Groszstengepardune
49. Grossbrampardune
50. Fockbrasse
51. Untermarsbrasse
52. Obermarsbrasse
53. Brambrasse
54. Roilbrasse
55. Piekfall
56. Baundirk
57. Vorstengewanten
58. Vorbramwanten
59. Groszstengewanten
60. Aussenklüverstampfstag
61. Klüverstampfstag
62. Stampfstockgei
63. Wasserstag

HERMAPHRODITE BRIG

1. flying jibboom
2. jibboom
3. bowsprit
4. martingale, dolphin striker
5. foremast
6. fore topmast
7. fore topgallant mast
8. fore royal mast
9. fore yard
10. lower topsail yard
11. upper topsail yard
12. topgallant yard
13. royal yard
14. main mast
15. main topmast
16. main topgallant mast
17. main boom
18. main gaff
19. flying jib
20. outer jib
21. inner jib
22. fore topmast staysail
23. foresail
24. lower topsail
25. upper topsail
26. topgallant sail
27. royal
28. main staysail
29. middle staysail
30. main topmast staysail
31. main topgallant staysail
32. main sail
33. gaff topsail
34. fore royal stay
35. fore topgallant stay
36. outer jib stay
37. inner jib stay
38. fore topmast stay
39. fore stay
40. fore shrouds
41. fore topmast backstay
42. fore topgallant backstay
- 42A. fore royal backstay
43. main stay
44. middle staysail stay
45. main topmast stay
46. main topgallant stay
47. main shrouds
48. main topmast backstay
49. main topgallant backstay
50. fore brace
51. lower topsail brace
52. upper topsail brace
53. topgallant brace
54. royal brace
55. peak halliard
56. boom topping lift
57. fore topmast shrouds
58. fore topgallant shrouds
59. main topmast shrouds
60. flying jibboom stay
61. jibboom stay
62. martingale guy
63. bobstay



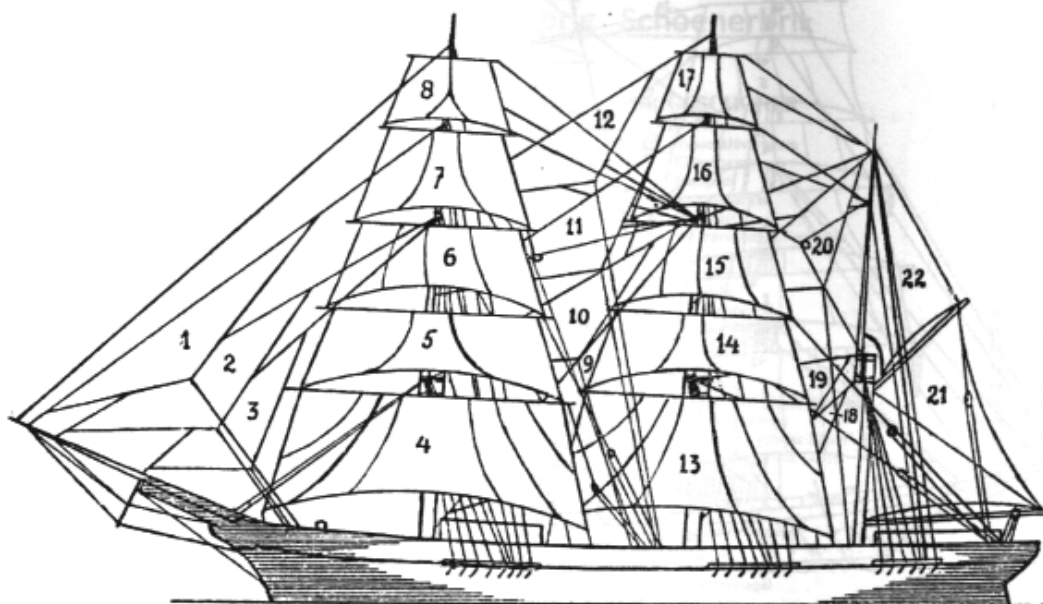
Ship Volschip

- 1= Fore Course (Fore Sail)
- 2= Fore lower topsail
- 3= Fore upper topsail
- 4= Fore lower t'gallant
- 5= Fore upper t'gallant
- 6= Fore royal
- 7= Main Course (Main Sail)
- 8= Main lower topsail
- 9= Main upper topsail
- 10= Main lower t'gallant
- 11= Main upper t'gallant
- 12= Main royal
- 13= Cro'jack (Crossjack)
- 14= Mizzen lower topsail
- 15= Mizzen upper topsail
- 16= Mizzen lower t'gallant
- 17= Mizzen upper t'gallant
- 18= Mizzen royal
- 19= Fore course braces
- 20= Fore lowertopsail braces
- 21= Fore uppertopsail braces
- 22= Fore lower t'gallant braces
- 23= Fore upper t'gallant braces
- 24= Fore royal braces
- 25= Fore course sheet
- 26= Fore course tack
- 27= Main sail braces
- 28= Main lowertopsail braces
- 29= Main uppertopsail braces
- 30= Main lower t'gallant braces
- 31= Main upper t'gallant braces
- 32= Main royal braces
- 33= Main sheet

- Fok
- Voor ondermars
- Voor bovenmars
- Voor bramzeil
- Voor top bramzeil
- Voor bovenbramzeil
- Grootzeil
- Groot ondermars
- Groot bovenmars
- Groot bramzeil
- Groot top bramzeil
- Groot boven bramzeil
- Bagijn
- Onder kruiszeil
- Boven kruiszeil
- Onder Grietje
- Midden Grietje (Grietje)
- Boven Grietje
- Fokke brassen
- Voor ondermars brassen
- Voor bovenmars brassen
- Voor bram brassen
- Voor top bram brassen
- Voor boven bram brassen
- Fokke schoot
- Fokke hals
- Grootzeil brassen
- Groot ondermars brassen
- Groot bovenmars brassen
- Groot bram brassen
- Groot topbram brassen
- Groot bovenbram brassen
- Groot zeil schoot

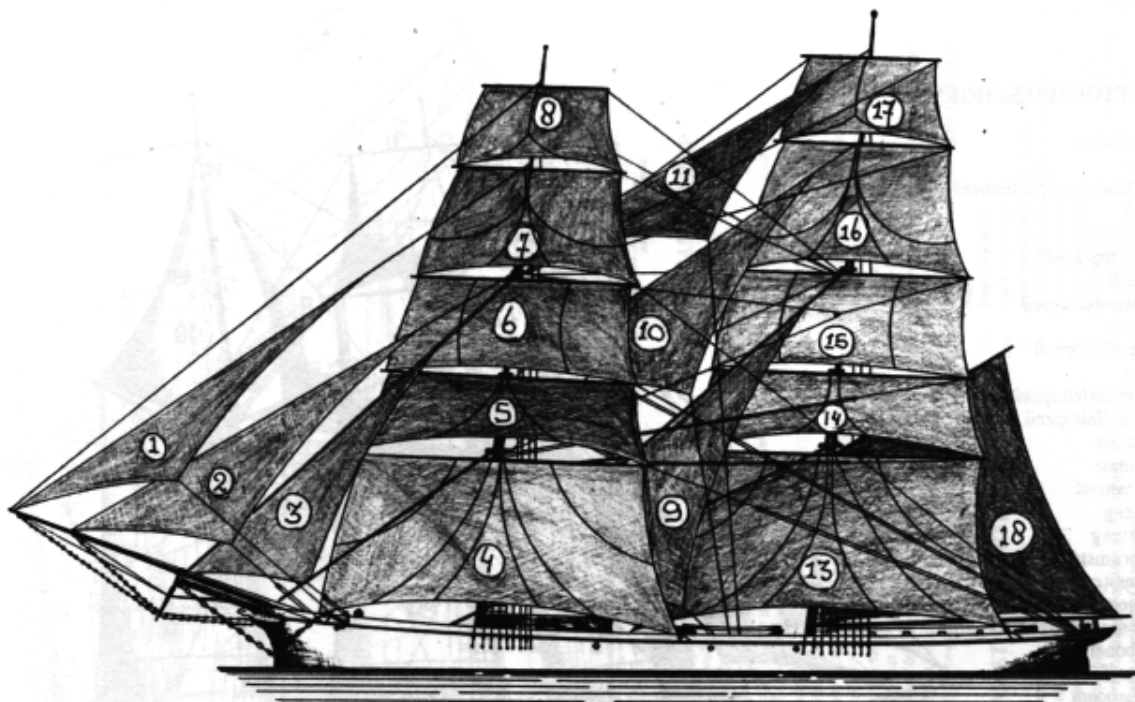
- 34= Main tack
- 35= Cro'jack braces
- 36= Mizzen lowertopsail braces
- 37= Mizzen uppertopsail braces
- 38= Mizzen lower t'gallant braces
- 39= Mizzen upper t'gallant braces
- 40= Mizzen royal braces
- 41= Cro'jack sheet
- 42= Cro'jack tack
- 43= Fore course yard
- 44= Fore lower topsail yard
- 45= Fore upper topsail yard
- 46= Fore lower t'gallant yard
- 47= Fore upper t'gallant yard
- 48= Fore royal yard
- 49= Main yard
- 50= Main lower topsail yard
- 51= Main upper topsail yard
- 52= Main lower t'gallant yard
- 53= Main upper t'gallant yard
- 54= Main royal yard
- 55= Cro'jack yard
- 56= Mizzen lowertopsail yard
- 57= Mizzen uppertopsail yard
- 58= Mizzen lower t'gallant yard
- 59= Mizzen upper t'gallant yard
- 60= Mizzen royal yard
- 61= Mizzen boom
- 62= Mizzen gaff
- 63= Spanker
- 64= Spanker sheet
- 65= Gaff preventer

- Groot zeil hals
- Bagijn brassen
- Kruis brassen
- Boven kruis brassen
- Onder grietje brassen
- Grietje brassen
- Boven grietje brassen
- Bagijn schoot
- Bagijn hals
- Fokke ra
- Voor ondermarse ra
- Voor bovenmarse ra
- Voor bram ra
- Voor top bram ra
- Voor boven bram ra
- Grote ra
- Groot ondermarse ra
- Groot bovenmars ra
- Groot bram ra
- Groot topbram ra
- Groot boven bram ra
- Bagijne ra
- Kruis ra
- Boven kruis ra
- Onder grietje ra
- Grietje ra
- Boven grietje ra
- Bezaans boom (Giek)
- Bezaans Gaffel
- Bezaan
- Bezaan schoot
- Gaffel geerde



Bark or Barque

- | | |
|-------------------------------|-----------------------------------|
| 1= Outer jib | Buiten kluiver |
| 2= Inner jib | Kluiver (binnen kluiver) |
| 3= Fore topmast staysail | Vorstenge stagzeil |
| 4= Fore course | Fok |
| 5= Fore lower topsail | Voor ondermars |
| 6= Fore upper topsail | Voor bovenmars |
| 7= Fore t'gallant | Voor onderbram |
| 8= Fore royal | Voor bovenbram |
| 9= Main topmast staysail | Grootstenge stagzeil (Dekzwabber) |
| 10= Main middle staysail | Groot midden stagzeil |
| 11= Main t'gallant staysail | Groot onderbramstengestagzeil |
| 12= Main royal staysail | Groot bovenbramstengestagzeil |
| 13= Maincourse (Mainsail) | Grootzeil |
| 14= Main lowertopsail | Groot ondermars |
| 15= Main uppertopsail | Groot bovenmars |
| 16= Main t'gallant | Groot onderbram |
| 17= Main royal | Groot bovenbram |
| 18= Mizzenstaysail | Bezaanstagzeil (Aap) |
| 19= Mizzentopstaysail | Bezaantopstagzeil |
| 20= Mizzen t'gallant staysail | Vlieger |
| 21=Spanker | Bezaan |
| 22=Gafftopsail | Gaffeltopzeil |



Brig

- 1= Outer jib
- 2= Jib
- 3= Fore topmast staysail
- 4= Fore Sail
- 5= Fore lowertopsail
- 6= Fore uppertopsail
- 7= Fore t'gallant
- 8= Fore royal
- 9= Main topmast staysail
- 10=Main t'gallant staysail
- 11=Main royal staysail
- 13= Main Sail
- 14= Lower main topsail
- 15= Upper main topsail
- 16= Main t'gallant
- 17= Main royal
- 18= Spanker

Brik

- Buiten kluiver
- Kluiver
- Voor stenge stagzeil
- Fok
- Voor ondermars
- Voor bovenmars
- Voor onderbram
- Voor bovenbram
- Dekzwabber (Groot stenge stagzeil)
- Groot onderbram stenge stagzeil
- Groot bovenbram stenge stagzeil
- Grootzeil
- Groot ondermars
- Groot bovenmars
- Groot onderbram
- Groot bovenbram
- Brikzeil

DRIEMASTTOPZEILSCHOENER

1. buitenkluiver
2. kluiver
3. voorstengestagzeil, binnenkluiver
4. stagfok
5. schoenerzeil
6. topzeil, marszeil
7. bramzeil
8. grootstengestagzeil
9. grootzeil
10. grootgaffeltopzeil
11. bezaan
12. bezaansgaffeltopzeil, achtergaffeltopzeil
13. fokkemast
14. grote mast
15. bezaansmast
16. voorsteng
17. grote steng
18. grootbramsteng
19. bezaanssteng
20. schoenerzeilboom, voorboom
21. schoenerzeilgaffel, voorgaffel
22. grote boom
23. grote gaffel
24. bezaansboom
25. bezaansgaffel
26. schoenerzeilschoot
27. grote schoot
28. bezaansschoot
29. fokkera
30. topzeilra
31. bramra
32. fokkewant
33. grootwant
34. bezaanswant
35. voorboomdirk, voordirk
36. grote boomdirk, grootdirk
37. bezaansboomdirk, bezaansdirk
38. buitensnavelstag
39. snavelstag, binnensnavelstag
40. achteruithouder
41. buitenkluiverschoot
42. kluiverschoot
43. binnenkluiverschoot
44. stagfokschoot
45. topzeilbuikgording
46. topzeilnokgording
47. brambuikgording
48. bramnokgording
49. gaffeltopzeilgei, bezaansgaffeltopzeilgei

TROIS-MÂTS GOÉLETTE

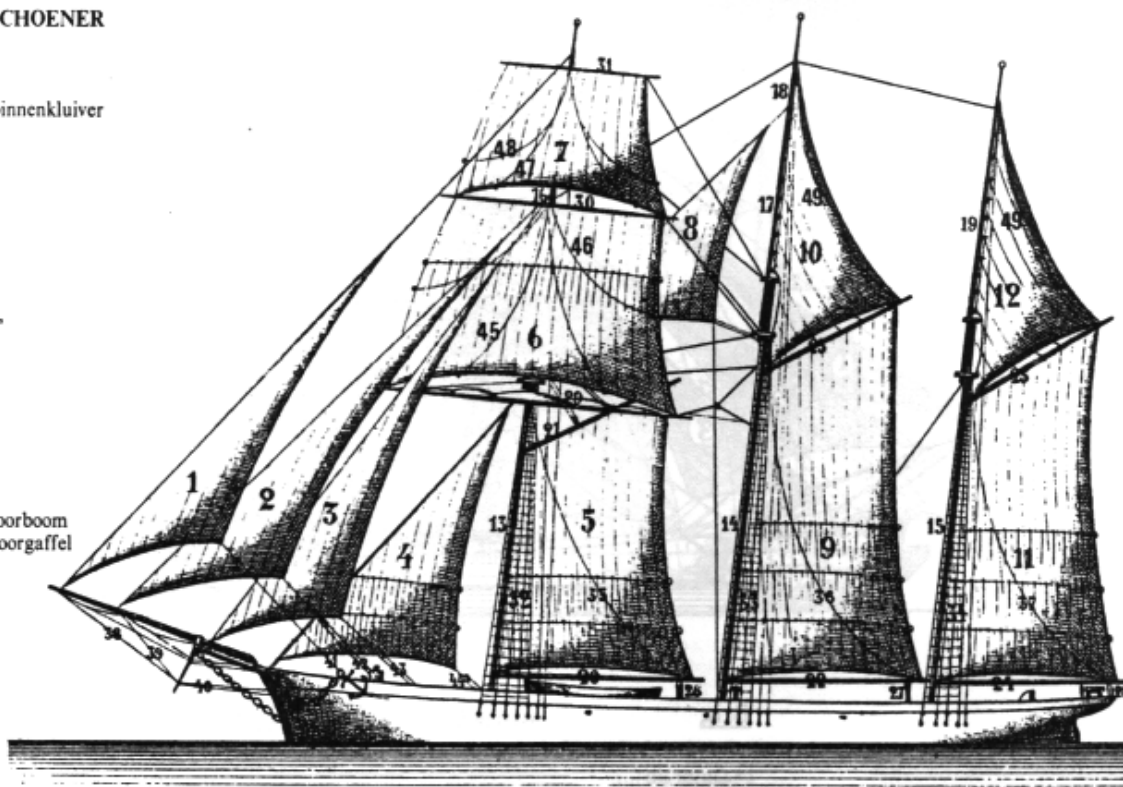
1. clin-foc
2. foc, grand foc
3. faux-foc
4. trinquette
5. misaine-goëlette
6. hunier
7. perroquet
8. voile d'étai de grand hunier
9. grand voile goëlette
10. grand voile de flèche, grande flèche
11. brigantine
12. flèche-en-cul
13. mât de misaine
14. grand mât
15. mât d'artimon
16. petit mât de hune
17. grand mât de hune
18. grand mât de flèche
19. mât de flèche d'artimon
20. gui de misaine-goëlette
21. corne de misaine-goëlette

DREIMASTTOPPEL-SCHÖNER

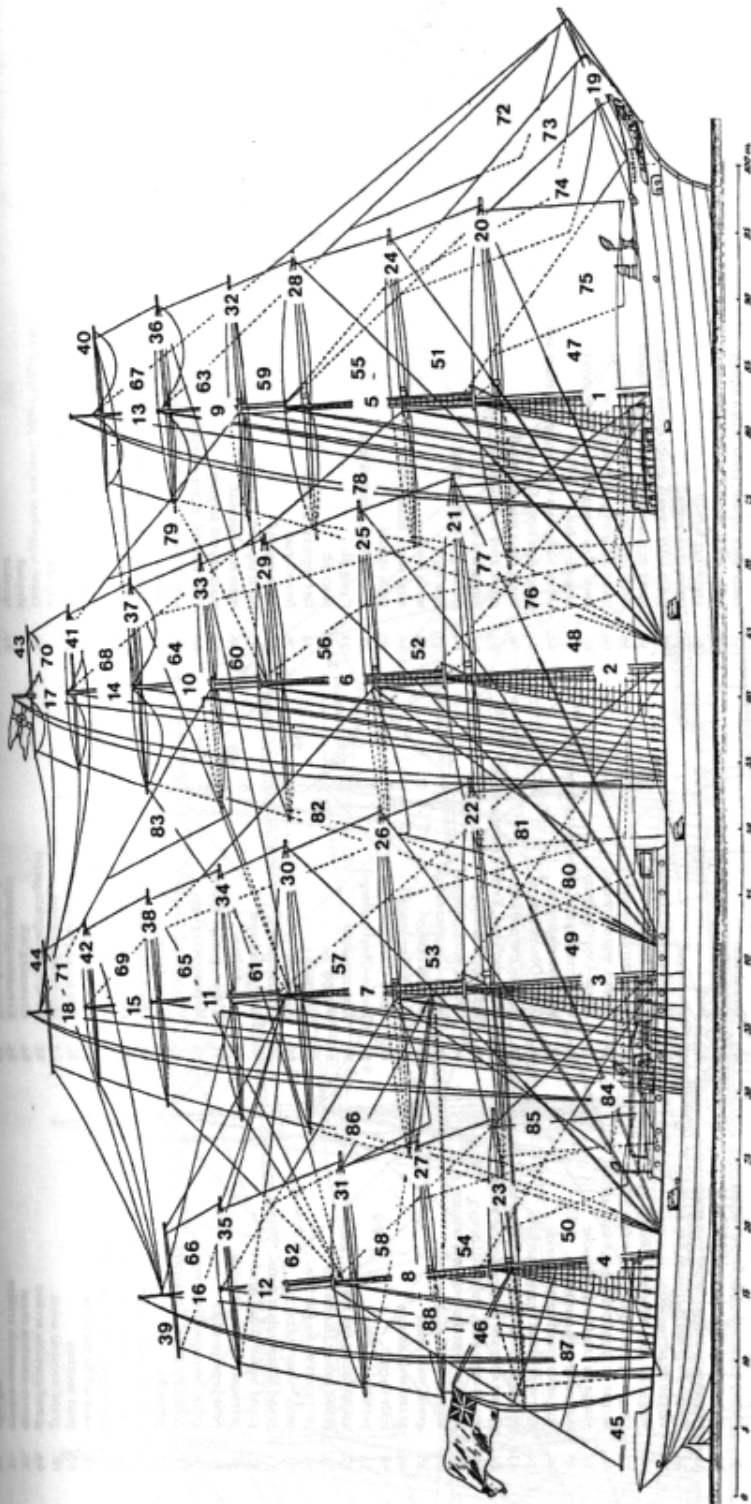
1. Aussenklüver
2. Klüver, grosser Klüver
3. Binnenklüver, Vorstengestagsegel
4. Stagfok
5. Schonersegel
6. Toppsel
7. Bramsel
8. Grosstengestagsegel
9. Grossegel
10. Grossgaffeltoppsel
11. Besan
12. Besangaffeltoppsel

THREE-MASTED TOPSAIL SCHOONER

1. flying jib
2. jib
3. inner jib, fore topmast staysail



13. Fokkemast
14. Grossmast
15. Besanmast
16. Vorstenge
17. Grosstenge, grosse Stenge
18. Grossbramstenge
19. Besanstenge
20. Schonersegelbaum, Vorbaum
21. Schonersegelgaffel, Vorgaffel
22. Grossbaum, grosser Baum
23. Grossgaffel, grosse Gaffel
24. Besanbaum
25. Besangaffel
26. Schonersegelschote
27. Groszschote, grosse Schote
28. Besanschote
29. Fockrah
30. Toppselgelahe
31. Bramrahe
32. Fockwanten
33. Grosswanten
34. Besanwanten
35. Vorbaumdirk
36. Grossbaumdirk
37. Besanbaumdirk
38. Aussenklüverstampfstag
39. Klüverstampfstag
40. Stampfstockgei
41. Aussenklüverschote
42. Klüverschote
43. Binnenklüverschote
44. Stagfokschoot
45. Toppselbauchgording
46. Toppselnockgording
47. Brambauchgording
48. Bramnokgording
49. Gaffeltoppselgei
4. fore staysail
5. foresail, boom foresail
6. topsail
7. topgallant sail
8. main topmast staysail
9. main sail
10. main gaff topsail
11. mizen
12. mizen gaff topsail
13. foremast
14. main mast
15. mizen mast
16. fore topmast
17. main topmast
18. main topgallant mast
19. mizen topmast
20. fore boom
21. fore gaff
22. main boom
23. main gaff
24. mizen boom
25. mizen gaff
26. fore sheet
27. main sheet
28. mizen sheet
29. fore yard
30. topsail yard
31. topgallant yard
32. fore lower shrouds
33. main lower shrouds
34. mizen lower shrouds
35. fore topping lift
36. main topping lift
37. mizen topping lift
38. flying jibboom stay
39. jibboom stay
40. martingale guy
41. flying jib sheet
42. jib sheet
43. inner jib sheet
44. fore staysail sheet
45. topsail buntline
46. topsail leech line
47. topgallant buntline
48. topgallant leech line
49. gaff topsail brail



VIERMASTVOLLSCHIP

1. fokkemast
2. grote mast
3. hoofdmast, achtermast
4. kruismast, jagermast
5. voormarssteng
6. grootmarssteng
7. hoofdmarssteng
8. achtermarssteng
9. kruismarssteng, jagermarssteng
10. grootbramsteng
11. hoofdbramsteng
12. kruisbramsteng, jagerbramsteng, Grietjessteng
13. voorbovenbramsteng
14. grootbovenbramsteng
15. hoofdbovenbramsteng, achterbovenbramsteng
16. kruisbovenbramsteng, jagerbovenbramsteng, bovengrietjessteng
17. grootscheizelsteng
18. hoofdscheizelsteng
19. hoornboegspriet
20. fokkera
21. grote ra

FOUR-MASTED SHIP

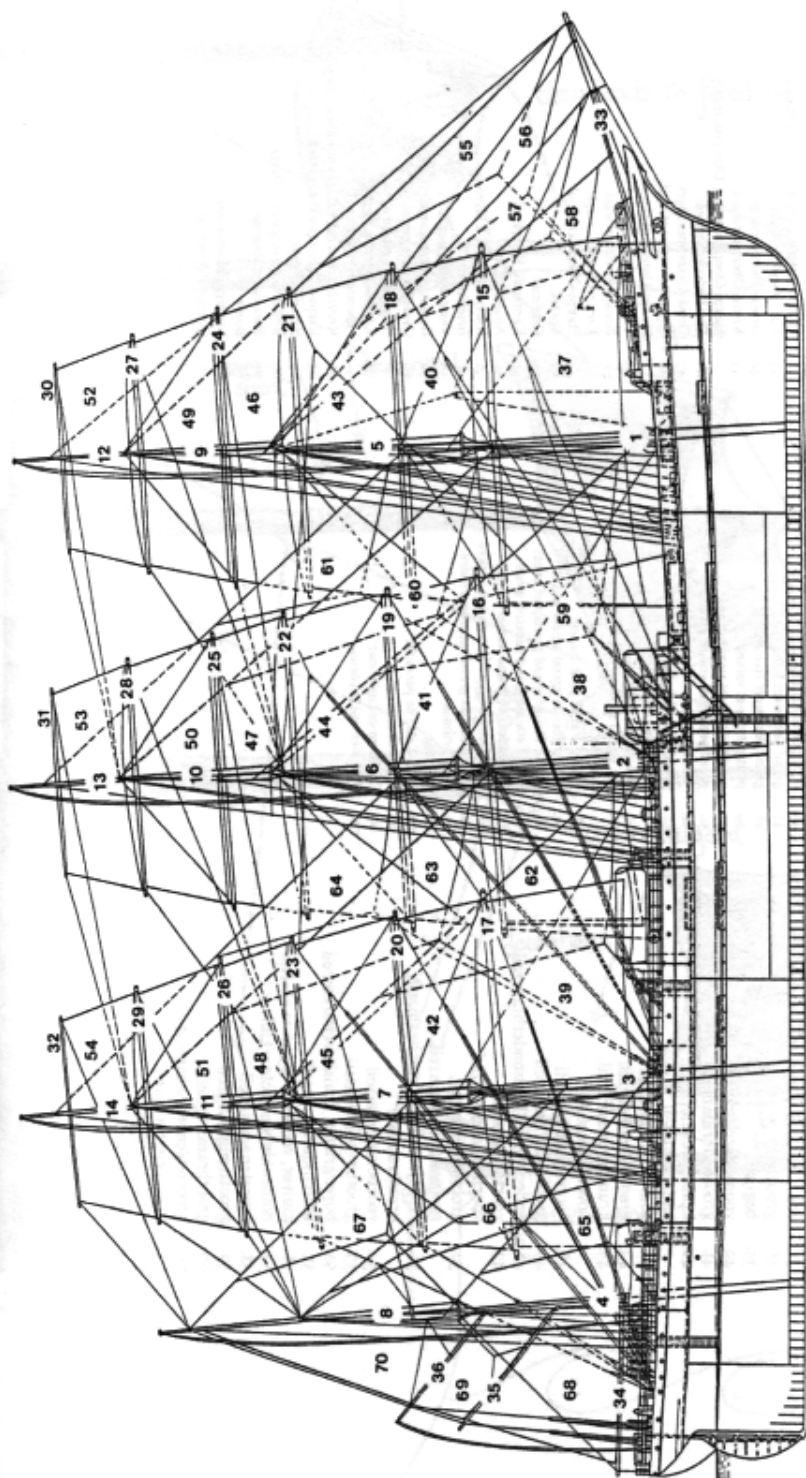
1. foremast
2. main mast
3. after mast, mizen mast
4. mizen mast, jigger mast
5. fore topmast
6. main topmast
7. after topmast, mizen topmast
8. mizen topmast, jigger topmast
9. fore topgallant mast
10. main topgallant mast
11. after topgallant mast, mizen topgallant mast
12. mizen topgallant mast, jigger topgallant mast
13. fore royal mast
14. main royal mast
15. after royal mast, mizen royal mast
16. mizen royal mast, jigger royal mast
17. main skysail mast
18. after skysail mast
19. bowsprit
20. fore yard
21. main yard
22. after yard, mizen yard
23. crossjack yard
24. lower fore topsail yard
25. lower main topsail yard
26. lower after topsail yard, lower mizen topsail yard

VIERMASTVOLLSCHIFF

1. Fockmast
2. Grootmast
3. Hauptmast, Achtermast
4. Kreuzmast
5. Voormarsstenge, Fockstenge, Vorstenge
6. Grootmarsstenge, Grootstenge
7. Hauptmarsstenge, Hauptstenge
8. Kreuzmarsstenge, Kreuzstenge
9. Vorbramstenge
10. Grootbramstenge
11. Hauptbramstenge
12. Kreuzbramstenge

QUATRE-MÂTS CARRÉ

22.	hoofdra, achterra	13.	Vorrolstege	27.	lower mizen topsail yard, lower jigger topsail yard
23.	begijnera	14.	Grosrolstege	28.	upper fore topsail yard
24.	voorondermarsera	15.	Hauptrolstege	29.	upper main topsail yard
25.	grootondermarsera	16.	Kreuzrolstege	30.	upper after topsail yard, upper mizen topsail yard
26.	hoofdondermarsera,	17.	Groscheisegelstege	31.	upper mizen topsail yard, upper jigger topsail yard
27.	achterondermarsera,	18.	Hauptscheisegelstege	32.	lower fore toppallant yard
28.	onderkruisra, jagerondermarsera	19.	Bugsjriet, Hornbugspriet	33.	lower main toppallant yard
29.	voorbovenmarsera	20.	lockrahe	34.	lower after toppallant yard, lower mizen toppallant yard
30.	grootbovenmarsera	21.	Grosrahe	35.	mizen toppallant yard, jigger toppallant yard
31.	hoofdbovenmarsera	22.	Hauptrahe, Achterrahe	36.	upper fore toppallant yard
32.	achterbovenmarsera	23.	Bagenrahe	37.	upper main toppallant yard, upper mizen toppallant yard
33.	kruisbovenmarsera,	24.	Vor-Untermarsrahe	38.	jigger royal yard
34.	bovenkruisra,	25.	Gros-Untermarsrahe	39.	fore royal yard
35.	jagerbovenmarsera	26.	Haupt-Untermarsrahe	40.	main royal yard
36.	voortopbramra	27.	Kreuz-Untermarsrahe, Unterkreuzrahe	41.	after royal yard, mizen royal yard
37.	grootopbramra	28.	Vor-Obermarsrahe	42.	main skysail yard
38.	hoofdtopbramra,	29.	Gros-Obermarsrahe	43.	after skysail yard, mizen skysail yard
39.	achtertopbramra	30.	Kreuz-Obermarsrahe, Oberkreuzrahe	44.	spanker boom
40.	voorbovenbramra	31.	Vor-Unterbramrahe	45.	fore sail
41.	grootbovenbramra	32.	Gros-Unterbramrahe	46.	main sail
42.	hoofdbovenbramra,	33.	Haupt-Unterbramrahe	47.	after sail, mizen
43.	achtbovenbramra	34.	Kreuzbramrahe	48.	crossjack
44.	hoofdscheizelra	35.	Vor-Oberbramrahe	49.	lowerfore topsail
45.	bezaansboom	36.	Gros-Oberbramrahe	50.	lower main topsail
46.	bezaansgaffel	37.	Haupt-Oberbramrahe	51.	lower after topsail, lower mizen topsail
47.	fok	38.	Kreuzrolrahe	52.	lower mizen topsail, lower jigger topsail
48.	grootzeil	39.	Vorrolrahe	53.	upper fore topsail
49.	hoofdzeil	40.	Grosrolrahe	54.	upper main topsail
50.	begijn	41.	Hauptrolrahe	55.	upper after topsail, upper mizen topsail
51.	voorondermarszeil	42.	Groscheisegelrahe	56.	upper mizen topsail, upper jigger topsail
52.	grootondermarszeil	43.	Hauptscheisegelrahe	57.	lower fore toppallant sail
53.	hoofdondermarszeil,	44.	Besansboom	58.	lower main toppallant sail
54.	achterondermarszeil,	45.	Besangaffel	59.	lower after toppallant sail, lower mizen topsail
55.	voorbovenmarszeil	46.	Fock	60.	topgallant sail
56.	grootbovenmarszeil	47.	Groszeil	61.	mizen toppallant sail, jigger toppallant sail
57.	hoofdbovenmarszeil,	48.	Hauptzeil, Achterszeil	62.	upper fore toppallant sail
58.	kruisbovenmarszeil,	49.	Bugien, Jigger	63.	upper main toppallant sail
59.	bovenkruiszeil,	50.	Vor-Untermarszeil	64.	upper after toppallant sail, upper mizen topsail
60.	jagerbovenmarszeil	51.	Gros-Untermarszeil	65.	topgallant sail
61.	vooronderbramzeil	52.	Haupt-Untermarszeil	66.	mizen royal, jigger royal
62.	grootonderbramzeil	53.	Unterkreuzzeil, Kreuz-Untermarszeil	67.	fore royal
63.	achtertopbramzeil,	54.	Vor-Obermarszeil	68.	after royal, mizen royal
64.	hoofdtopbramzeil,	55.	Gros-Obermarszeil	69.	main skysail
65.	achtertopbramzeil,	56.	Haupt-Obermarszeil	70.	after skysail, mizen skysail
66.	bovengrietjeszeil,	57.	Oberkreuzzeil, Kreuz-Obermarszeil	71.	after skysail, mizen skysail
		58.	Vor-Unterbramzeil	72.	after skysail, mizen skysail
		59.	Gros-Unterbramzeil	73.	outer jib
		60.	Haupt-Unterbramzeil	74.	fore topsail
		61.	Kreuzbramzeil	75.	fore staysail
		62.	Vor-Oberbramzeil	76.	main staysail
		63.	Gros-Oberbramzeil	77.	main topsail staysail
		64.	Haupt-Oberbramzeil	78.	main royal staysail
		65.	Kreuzrolzeil	79.	main skysail staysail
		66.	Vorrolzeil	80.	after staysail, mizen staysail
		67.	Grosrolzeil	81.	after topsail staysail, mizen topsail staysail
		68.	Hauptrolzeil	82.	after staysail, mizen royal staysail
		69.	Groscheisegel	83.	staysail
		70.	Hauptscheisegel	84.	staysail
		71.	Aussenskliver	85.	mizen staysail, jigger staysail
		72.	Kliver, groter Kliver	86.	mizen topsail staysail, jigger topsail staysail
		73.	Vorstengestagel	87.	mizen topsail staysail, jigger topsail staysail
		74.	Vorstagel, Staglock		
		75.	Grosstagsel		
		76.	Grosstagsel		
		77.	Grosstagsel		
		78.	Grosstagsel		
		79.	Grosstagsel		
		80.	Grosstagsel		
		81.	Grosstagsel		
		82.	Grosstagsel		
		83.	Grosstagsel		
		84.	Grosstagsel		
		85.	Grosstagsel		
		86.	Grosstagsel		
		87.	Grosstagsel		



FOUR-MASTED BARQUE

1. foremast
2. main mast
3. mizen mast
4. jigger mast
5. fore topmast
6. main topmast
7. mizen topmast
8. jigger topmast
9. fore topgallant mast
10. main topgallant mast
11. mizen topgallant mast
12. fore royal mast
13. main royal mast
14. mizen royal mast
15. fore yard
16. main yard
17. mizen yard, crossjack yard
18. lower fore topmast yard
19. lower main topmast yard
20. lower mizen topmast yard

VIERMASTBARK

1. Fockmast
2. Grootmast
3. Kreuzmast, Hauptmast
4. Besanmast
5. Vornmarsstenge, Vornstenge, Fockstenge
6. Grootmarsstenge, Grootstenge
7. Kreuzmarsstenge, Kreuzstenge
8. Besanstenge
9. Vornbramstenge
10. Grootbramstenge
11. Kreuzbramstenge, Hauptstenge
12. Vornroloistenge
13. Grootroloistenge
14. Kreuzroloistenge, Hauptroloistenge
15. Fockrahe
16. Grootrahe
17. Besanrahe
18. Vor-Untermarsrahe
19. Groot-Untermarsrahe

QUATRE-MÂTS BARQUE

1. mâit de misaine
2. grand mâit avant
3. grand mâit arrière
4. mâit d'artimon
5. petit mâit de hune
6. grand mâit de hune avant
7. grand mâit de hune arrière
8. mâit de flèche d'artimon
9. petit mâit de perroquet
10. grand mâit de perroquet avant
11. grand mâit de perroquet arrière
12. petit mâit de cacatois
13. grand mâit de cacatois avant
14. grand mâit de cacatois arrière
15. vergue de misaine
16. vergue de grand mâit avant
17. vergue de grand mâit arrière
18. vergue de petit huiiler fixe
19. vergue de grand huiiler fixe avant
20. vergue de grand huiiler fixe arrière

VIERMASTBARK

1. fokkemast
2. grote mast
3. hoofdmast, kruismast
4. bezaansmast, jagermast
5. voormarssteng
6. grootmarssteng
7. kruissteng
8. bezaanssteng
9. voortramsteng
10. grootbramsteng
11. kruisbramsteng, Grietjessteng
12. voortbovenbramsteng
13. grootbovenbramsteng
14. kruisbovenbramsteng, bovengrietjessteng
15. fokkera
16. grote ra
17. begijnra

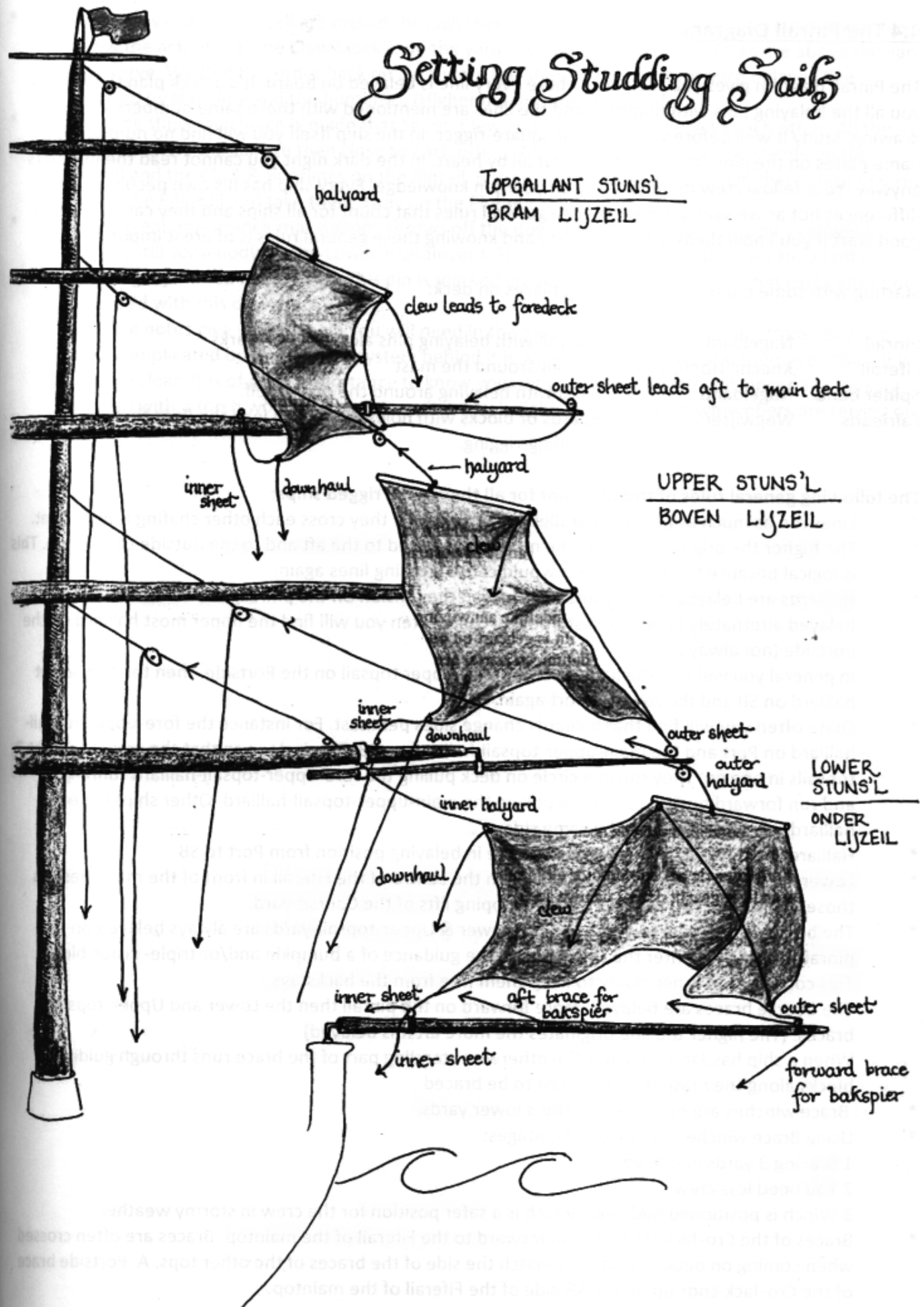
18. voorondermarsera
 19. grootondermarsera
 20. kruisondermarsera, onderkruisra
 21. voorbovenmarsera
 22. grootbovenmarsera
 23. kruisbovenmarsera, bovenkruisra
 24. vooronderbramra
 25. grootonderbramra
 26. ondergrietjesra,
 27. kruisonderbramra
 28. voortopbramra,
 29. voormiddenbramra
 30. grootopbramra,
 31. grootmiddenbramra
 32. kruisopbramra, Grietjesra,
 33. kruisbramra
 34. voorbovenbramra
 35. grootbovenbramra
 36. bovengrietjesra,
 37. kruisbovenbramra
 38. hoornboegspriet
 39. bezaansboom
 40. seingaffel
 41. fok
 42. grootzeil
 43. begin
 44. voorondermarszeil
 45. grootondermarszeil
 46. kruisondermarszeil,
 47. onderkruiszeil
 48. voorbovenmarszeil
 49. grootbovenmarszeil
 50. kruisbovenmarszeil,
 51. bovenkruiszeil
 52. vooronderbramzeil
 53. grootonderbramzeil
 54. ondergrietje, kruisonderbramzeil
 55. voortopbramzeil,
 56. voormiddenbramzeil
 57. grootopbramzeil
 58. Grietjeszeil, kruisopbramzeil,
 59. kruisbramzeil
 60. voorbovenbramzeil
 61. grootbovenbramzeil
 62. bovengrietje, kruisbovenbramzeil
 63. buitenkluiver, jager
 64. kluiver, voorkluiver, grote kluiver
 65. binnenkluiver, achterkluiver
 66. voortengestagzeil
 67. grootstengestagzeil
 68. grootbramstagzeil
 69. grootbovenbramstagzeil
 70. kruisstengestagzeil
 71. Grietjesstagzeil,
 72. kruisbramstagzeil
 73. bovengrietjesstagzeil,
 74. kruisbovenbramstagzeil
 75. bezaansstagzeil, aap
 76. vlieger
 77. boventvlieger
 78. bezaan, onderbezaan,
 79. kruisgaffelzeil
 80. bovenbezaan
 81. gaffeltopzeil

21. vergue de petit hunier volant
 22. vergue de grand hunier volant avant
 23. vergue de grand hunier volant arrière
 24. vergue de petit perroquet
 25. vergue de grand perroquet fixe avant
 26. vergue de grand perroquet fixe arrière
 27. vergue de petit perroquet volant
 28. vergue de grand perroquet volant avant
 29. vergue de grand perroquet volant arrière
 30. vergue de petit cacatois
 31. vergue de grand cacatois avant
 32. vergue de grand cacatois arrière
 33. beaupé
 34. gui de brigantine, gui d'artimon
 35. corne de brigantine inférieure, corne
 36. d'artimon inférieure
 37. corne de brigantine supérieure, corne
 38. d'artimon supérieure
 39. misaine
 40. grand'voile avant
 41. grand'voile arrière
 42. petit hunier fixe
 43. grand hunier fixe avant
 44. grand hunier fixe arrière
 45. petit hunier volant
 46. grand hunier volant avant
 47. grand hunier volant arrière
 48. petit perroquet fixe
 49. grand perroquet fixe avant
 50. grand perroquet fixe arrière
 51. petit perroquet volant
 52. grand perroquet volant avant
 53. grand perroquet volant arrière
 54. petit cacatois
 55. grand cacatois avant
 56. grand cacatois arrière
 57. clin-foc
 58. foc, grand foc
 59. faux-foc
 60. voile d'étai de petit hunier
 61. voile d'étai de grand hunier avant
 62. voile d'étai de grand hunier arrière
 63. voile d'étai de grand cacatois avant
 64. voile d'étai de grand cacatois arrière
 65. foc d'artimon
 66. diabolon
 67. voile d'étai de perruche
 68. brigantine, artimon
 69. flèche-en-cul inférieur
 70. flèche-en-cul supérieur

20. Kreuz-Untermarsrahe,
 21. Haupt-Untermarsrahe, Unterkreuzrahe
 22. Vor-Obermarsrahe
 23. Gross-Obermarsrahe
 24. Kreuz-Obermarsrahe, Oberkreuzrahe
 25. Vor-Unterbramrahe
 26. Gross-Unterbramrahe
 27. Haupt-Unterbramrahe
 28. Vor-Oberbramrahe
 29. Gross-Oberbramrahe
 30. Haupt-Oberbramrahe
 31. Vorroil
 32. Grossroil
 33. Kreuzroil, Hauptroil
 34. Bugspriet
 35. Besanbaum
 36. Unterbesangaffel
 37. Oberbesangaffel
 38. Fock
 39. Grouzsegel
 40. Baglensegel
 41. Vor-Untermarssegel
 42. Kreuz-Untermarssegel,
 43. Haupt-Untermarssegel, Unterkreuzsegel
 44. Vor-Obermarssegel
 45. Gross-Obermarssegel
 46. Kreuz-Obermarssegel, Oberkreuzsegel
 47. Haupt-Unterbramsegel
 48. Gross-Unterbramsegel
 49. Kreuz-Unterbramsegel,
 50. Haupt-Unterbramsegel
 51. Vor-Oberbramsegel
 52. Gross-Oberbramsegel
 53. Kreuz-Oberbramsegel
 54. Haupt-Oberbramsegel
 55. Vorroil
 56. Grossroil
 57. Kreuzroil, Hauptroil
 58. Ausenklüver
 59. Klüver, grosser Klüver
 60. Innenklüver
 61. Vorstengestagsegel
 62. Grossstengestagsegel
 63. Grossbramstagsegel
 64. Grossroilstagsegel
 65. Kreuzstengestagsegel
 66. Hauptstengestagsegel
 67. Kreuzroil, Hauptroilstagsegel
 68. Besanstagsegel
 69. Besanstengestagsegel, Flioger
 70. Besanbramstagsegel
 71. Besan
 72. Unterroil
 73. Oberroil

21. upper fore topsail yard
 22. upper main topsail yard
 23. upper mizen topsail yard
 24. lower fore topgallant yard
 25. lower main topgallant yard
 26. lower mizen topgallant yard
 27. upper fore topgallant yard
 28. upper main topgallant yard
 29. upper mizen topgallant yard
 30. fore royal yard
 31. main royal yard
 32. mizen royal yard
 33. bowsprit
 34. spankerboom
 35. lower spanker gaff
 36. upper spanker gaff
 37. foresail
 38. main sail
 39. mizen sail, crossjack
 40. lower fore topsail
 41. lower main topsail
 42. lower mizen topsail
 43. upper fore topsail
 44. upper main topsail
 45. upper mizen topsail
 46. lower fore topgallant sail
 47. lower main topgallant sail
 48. lower mizen topgallant sail
 49. upper fore topgallant sail
 50. upper main topgallant sail
 51. upper mizen topgallant sail
 52. fore royal
 53. main royal
 54. mizen royal
 55. flying jib
 56. jib, outer jib
 57. inner jib
 58. fore topmast staysail
 59. main topmast staysail
 60. main topgallant staysail
 61. main royal staysail
 62. mizen topmast staysail
 63. mizen topgallant staysail
 64. mizen royal staysail
 65. jigger mast staysail
 66. jigger topmast staysail
 67. jigger topgallant staysail
 68. spanker
 69. lower gaff topsail
 70. upper gaff topsail

Setting Studding Sails



4.4 The Pinrail Diagram

The Pinrail diagram gives you the place where every line is belayed on board. It's a deck plan that shows you all the belaying pins with numbers and the lines are mentioned with these same numbers in the drawing. Study it well before you join your square-rigger. In the ship itself you will find no numbers or name plates on the pins. You have to learn it all by heart. In the dark night you cannot read the numbers anyway. Your fellow crew members rely on your pin knowledge. Every ship has his own peculiar differences but as we said before there are general rules that count for all ships and they can give you a good start if you know them. Understanding and knowing these general rules is of great importance.

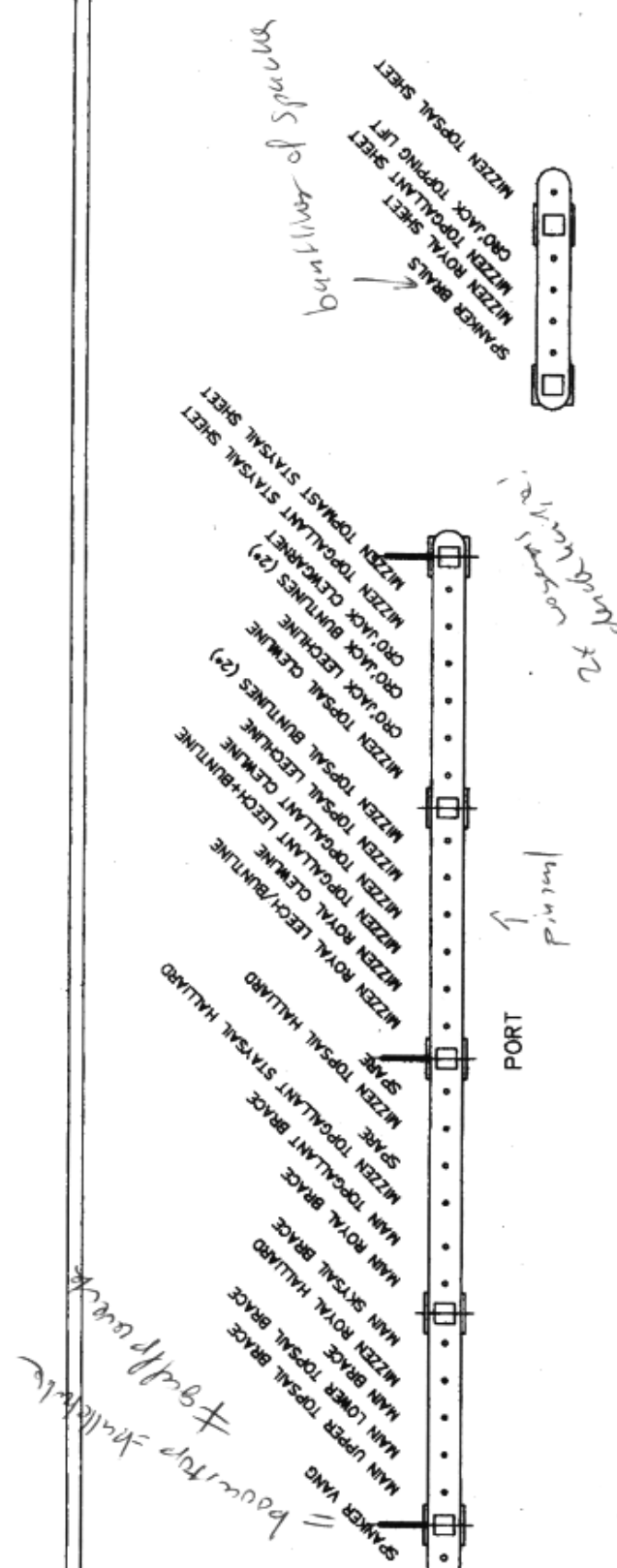
Starting with some names of the belaying places on deck:

Pinrail	Nagelbank	The rail with belaying pins along the bulwarks
Fiferail	Knecht/Hoefijzer	Pin-rail around the mast
Spider band	Nagelband	Band with belaying around the mast itself.
Fairleads	Wegwijzers	Boards or blocks with holes in them to lead the lines through the standing-rigging.

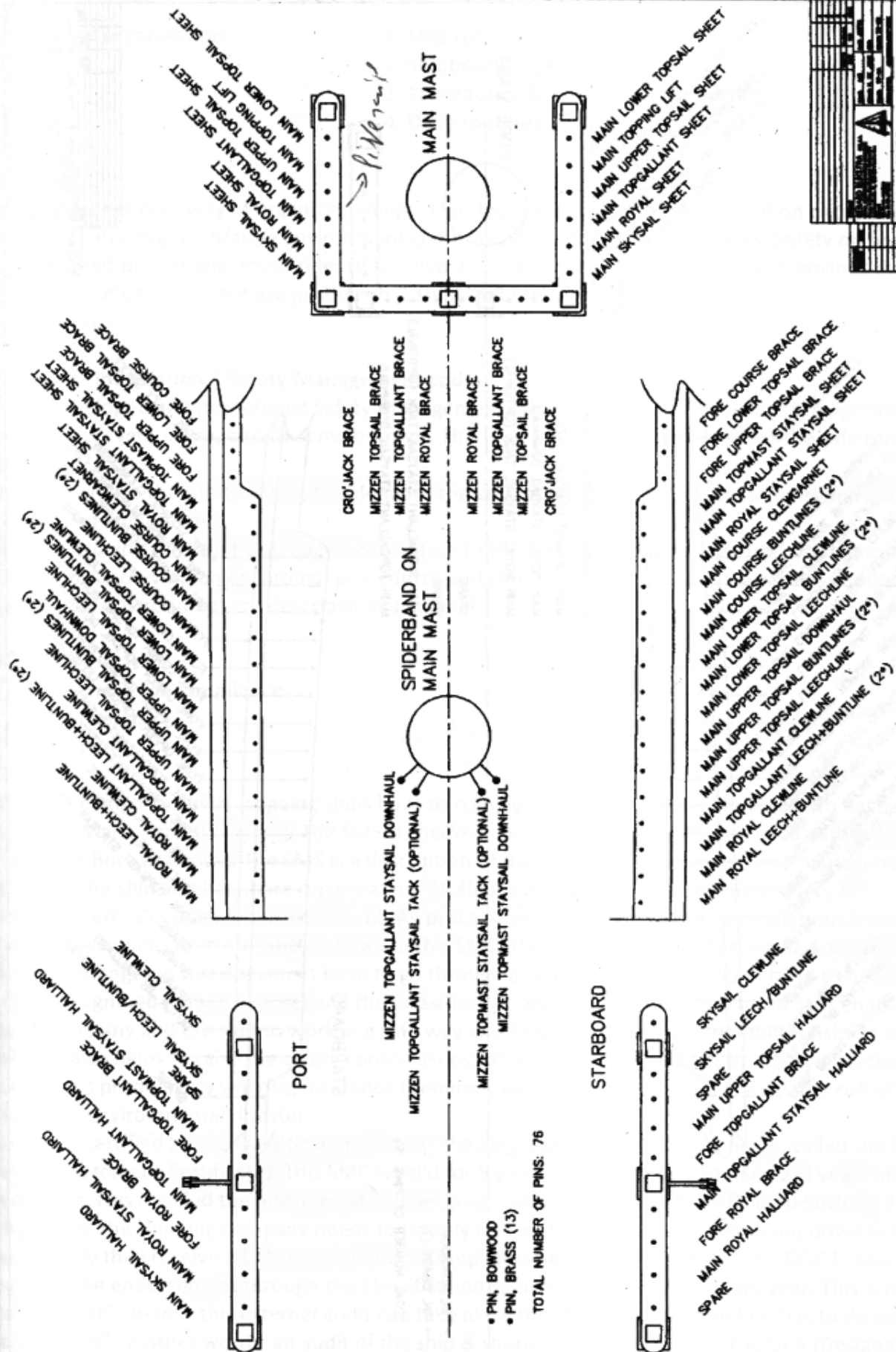
The following general rules of thumb count for all the square rigged ships:

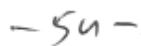
- * Lines run as much as possible parallel to each other. If they cross each other chafing is imminent.
- * The higher the origin of the line, the more it is belayed to the aft and to the outside of the ship. This is logical because the raking masts would cause crossing lines again.
- * Halliards are belayed on the Pinrail. To spread the tension on the pinrail, the different halliards are belayed alternately to port and starboard. Quite often you will find the upper most halliard on the portside (not always)
- * In general you will find the halliard of the fore-upper topsail on the Portside, then the topgallant halliard on SB and the royal on port again.
- * Quite often you will find that halliards change sides per mast. For instance the fore-upper-topsail-halliard on Port and the main-upper-topsail-halliard on SB. This is done so that the crew can hoist 2 topsails in one go. They run in a circle on deck pulling the fore-upper-topsail-halliard running aft and run forward on SB again while pulling the main-upper-topsail-halliard. Other ships have the halliards on both masts on the same side.
- * Halliards of staysails and jibs also alternate in belaying position from Port to SB.
- * Lower-topsail-sheets are always belayed in the centre of the Fiferail in front of the mast. Besides those two sheets you will find the two topping lifts of the Course-yard.
- * The braces of the Course-yards and the Lower & Upper-topsail-yards are always belayed on the pinrail. Often they enter the ship through the guidance of a bumpkin and/or triple- sister-blocks. This construction is necessary to keep them free from the backstays.
The Course braces are belayed more forward on the pinrail then the Lower and Upper-topsail braces. (The higher the line originates the more aft it is belayed)
When a ship has Jarvis winches the otherwise standing part of the brace runs through guiding blocks along the mast abaft the mast to be braced.
- * Brace winches are only used for the 3 lower yards.
- * Using Brace winches has some advantages:
 - 1 Bracing 3 yards in one go,
 - 2 You need less crew,
 - 3 Winch is positioned mid-ships which is a safer position for the crew in stormy weather.
- * Braces of the Cro-Jack (Mizzen) run forward to the Fiferail of the maintop. Braces are often crossed when coming on deck so that they match the side of the braces of the other tops. A Portside brace of the Cro-Jack ends up on the SB-side of the Fiferail of the maintop.

- * The sheets of a square-sail are reefed through sheet blocks on the aft side of the yardarm which is below the actual sail. The Clew block is on the yard itself and the Buntline-blocks are above the yard they serve. We find this order back on deck where the Sheet is the most forward belayed line followed by the Clew and the Buntlines. (Higher means more to the aft)
 - * On some ships the choice is made that Sheet, Clew and Buntlines are close to each other. All the lines to handle the sail are then close to each other. Most of the ships have the sheets on the Fiferail and the Clew & Buntlines on the Pinrail. (Europa & Stad Amsterdam). On these ships you set sail on the Fife-rail and take them away on the Pinrail.
 - * It is of great importance that nobody throws off the downhaul of the Upper-topsail-yard while there is still somebody on the Lower-topsail-yard. The yard can tip over and crew can fall off the yard or get jammed in between. This pin is marked on many ships so you know that extra attention is needed with this downhaul.
- All these notes give you the help you will need in the maze of lines that is coming from above. It looks complicated but finding the system behind it is what you need to do and then everything will become clear. It is of great importance to know your way around in all circumstances and looking up even with a torch won't help you in a pitch black night. Your fellow crewmembers are relying on you!



TOTAL NUMBER OF PINS: 58





Chapter 5.

5.1 Shipboard organisation.

1. Ship rules.
2. Shipboard organisation.
3. Procedures, Checklists and Reporting.
4. Daily routines.

1. Ship rules.

Every ship has her own way of organizing things. The ship's organization depends a lot on circumstances. Safety and protecting the Marine environment is the leading factor in all these cases. Safety on board depends a great deal on the house rules of the ship and crew following these rules. It is obvious that every year there are more rules that are pushed onto ships and their shore organizations. Some examples

ISM – Code: International Safety Management code.

The IMO developed an International Safety Management code, a code that stands for safe operation of ships and to prevent damage to the environment. This is an International standard for the safe running and operation of ships.

Goal: To increase the safety at sea, to safeguard the environment and to prevent injuries and damage to personnel and equipment.

Means: To provide rules and a management system to the ship and its shore organisation that makes the whole organization verifiable. Through procedures and checklists the shipboard operations connected to safety and the environment are described in a manual.

In this way it is easier:

- To check for compliance.
- To exercise.
- To verify.

*in NL voor zeelieden: DPA is organisatie
Zach Rood Brouwer die voor de
scheep te land was overloopt 5h*

All shipping-companies with seagoing ships have to comply with the ISM code. They need to have a ratified SMS (Safety Management System). The SMS is checked and certified by an official Classification Society, like Lloyds or Bureau Veritas. The SMS is a description of the complete organisation and management structure of the ship and her shore organisation. All shipboard operations concerning safety & environment are laid down in this document. All procedures, standing orders and regulations from the ship and the shore organisation are written down in this SMS. The SMS is a so called controlled document. That means that changes in this document have to go through a laid down procedure and need to be verified by the DPA (Designated Person Ashore) and the Classification Society. A proper structured SMS enables the shipping company and the ship to work in a safe way and keep safety and environmental risks as low as possible. It also helps to raise the safety consciousness of the crew and by doing so is cost-effective. Efficiency and productivity will rise, insurance premiums will go down and there is a smaller risk of claims in case of an environmental disaster.

If the SMS is certified by the Classification Society, the Flag-state will issue a certificate, called the SMC (Safety Management Certificate). This SMC is valid for 5 years and has to be endorsed 2 ½ years after the date of issue. This is called the intermediate survey and is also done by the Classification Society. Before getting a SMC the shipping company needs to comply also with certain requirements put down in the SMS. If they comply they receive a DOC (Document of Compliance) from the Flag-state. This DOC is also valid for 5 years but the endorsement through the Classification Society has to be done every year. This is called an "external audit". Before this external audit can take place the shore organisation first has to do an "internal audit", in other words: an audit of the ship & shore organisation itself. The DPA (Designated Person Ashore) is a trained member of the shore organisation and he or she carries out an audit with the ship and verifies if the SMS is working and followed up by shore and ship.

→ BSE of Rhine

An example: The SMS mentions that for a safe navigation the BA charts on board are updated through the weekly NTM's (Notice to Mariners). This is the responsibility of the second Mate and is registered in a folder in the Charthouse. During an internal audit the second Mate is asked to show the folder and the corrected charts. The external audits are all done by the Classification Society that is responsible for the ISM.

2. Shipboard Organisation.

The following points are taken into consideration when making up the organisation on board.

Objectives of the ship:

1. Education: Maritime or other.
2. Sailing with cargo.
3. Sailing with guests or trainees.
4. Sailing with special groups like disabled, drop-outs, etc.
5. Sailing in a campaign or promotion, racing.
6. Expeditions in special area's.

Size & type of the ship.

A two mast fore and aft schooner will be sailed differently than a full-rigged ship with a length of 100m and 120 cadets or trainees on board. In other words: every ship has her own special organisation structure tailored to the ship and the crew.

Commanding style.

The style of command is very dependent on the Captain and the Shipping Companies tradition on this. You will find very different styles of Command in the modern Tall ship fleet. On one side the military approach with strict rules for every individual to obey, and on the other side the more (seemingly) loose approach that gives personalities a chance to excel above the group and where the crew is encouraged to consider why certain commands are taken by the officers. Both forms have pro and cons and individuals also experience the two systems in different ways. For some crewmembers it is a lot easier to have a strict line of command and they know exactly where they stand and what they have to do. For others this system is too dull and they need more action and the possibility to act and think for themselves so that they can contribute fully to the crew. In all the different styles that are possible there has to be good cohesion between the commanding and the executive power. Above all, the commanding style has to comply in all situations with the SMS of the ship.

Crew.

It doesn't matter on which ship you sail you will always find a structure in place that complies with the following points:

- **Management**
- **Coordination**
- **Execution**

If you are on your own, you have to do all these tasks by yourself. If there is a crew of 120 on board, you can't do it all by yourself and you have to delegate. You need a structure to make sure that all the jobs that have to be done are completed in a timely and orderly fashion. You can find the following division into categories:

1. Management

It is obvious that the Captain is in charge of the ship and has overall responsibility. He has to keep an eye on everything. When the ship is small, the Captain is not only in charge but will also have other jobs, for instance as an officer of the watch and being in charge of certain other jobs. When the crew is bigger the Captain will move more and more to the overseeing officer's side and he will delegate a lot of the jobs to the other officers. The legislator supports the Captain in his job of being in charge and making decisions. The Captain has an "overriding authority" and in cases of safety he can decide against standard regulations.

2. Coordination

This is the responsibility of the Chiefs on board, these are:

Chief Officer for the Navigation & Administration department

Chief Engineer for the technical department.

Chief Cook for the food department.

Chief Purser for the smooth running of the Passengers/Trainees/Crew department.

Bosun for the deck & rigging department.

It is important that all these Chiefs have a clear job-description.

As example some job description for the mates.

1st Mate (Chief Mate):
Crew matters.
Safety matters.
Certificate's, Authorities, Clearing customs etc.
Education & Training crew.

2nd Mate:
Head nautical affairs
Nautical equipment, charts, pilots & nautical publications.
Communication
Weather Forecasts
National & Signal flags, time keeping on board etc.

Tasks can be with different people on different ships, it's just important that somebody is responsible for them.

3. Execution

Deck: Bosun, Deckhands, Trainees and other Crewmembers.

Engine room: Oiler, Engineer, Electrician.

Service department: Housekeeping, service crew, cooks & bakers.

Many jobs will be combined on the smaller ships but the tasks are still there, so there has to be a structure to get all the jobs done.

3. Procedures, Checklists and Reporting

Procedures

To make sure that a lot of recurring jobs on board run smoothly there are procedures for those jobs. In this way everybody does the job the same and proper way and it is easy to administrate and control. The amount of procedures can differ per ship, but you will find the underneath mentioned procedures or Flowcharts in every SMS system:

- Fire
- Abandon ship
- Man Over Board (MOB)
- Bunkering
- Garbage Management
- Grounding
- Familiarisation
- Piracy

learn your ship and specific area of your work

Checklists

Checklists are lists on which you can cross-off items that you have completed. In this way you are certain that all the procedures have been done properly and in the right order. It is also to make sure that you don't forgot an item, especially in a stress situation. There are checklists for:

- Arrival & Departure.
- Bunkering
- Familiarisation
- Accidents
- Etc.

Reporting

When an organisation becomes larger than 1 person it will be necessary to relay information to the rest. This can be done from mouth to mouth but with that system you will quickly run into misunderstandings and the information becomes untrustworthy. To overcome this problem you can write down everything that is done. With all the electronic devices that are common these days, it's not necessary to have everything printed in black and white anymore. The advantage of keeping a record is that you can keep these records for later use, feedback, or for other parties. Keeping records is also important for proof in cases of accidents or non-conformities. In those situations it is crucial to have proper record keeping in place. In case of an accident, a ships-statement has to be made up and a proper and well-kept deck journal makes it easier and will be more convincing in a later inquiry. Besides this, it is important to keep records of all exercises and instructions, so if an inspection takes place it is easy to prove that you took all the necessary measures to keep the ship and crew well equipped and trained.

Record keeping and reporting is important and for a number of cases the ISM requires you to make a report.

The SMS is defines the following reports;

- * Accidents Reports
- * Non-Conformity Reports
- * Hazardous Occurrence Reports

Besides the reporting of the above mentioned serious cases, is it also of great interest to learn the lessons of these cases. So that in the future these mishaps or near mishaps do not occur anymore.

These reports do not only contain a description of the N.C. that happened but they also try to define the reason why it happened and what can be done in the future to prevent it from happening again.

If, during a whole year no Accident- or Non Conformity report was made up on board, you have to convince the DPA or the Class Society surveyor that you are running the ideal organisation where no mishaps occur. But it could be also a case of not keeping a proper record of ongoing on-board operations.

4) Watches and Working hours

There are many different kind of Watch-schedules that can be used on board, depending on the size and standard of your crew, the rigging form and the size of your ship, the sailing program but also the waters you are going to sail in. Besides that, there are also regulations that you have to consider while making a watch schedule. Crewmembers should have a total of 10 hours of sleep per 24hrs and 6 of these should be without interruption. It makes a big difference if you are working in a day-watch or if you are part of a sea-watch. A 2 watch system is still possible but a 3 watch system makes it a lot easier to comply with the regulations.

Different Watch systems;

4 watches: 4 on, 8 off, 1 stand-by-watch.

3 watches: 4 on, 8 off.

2 watches: 6 on, 6 off.

5 on, 5 off, 7 on, 7 off. (6 on, 6 off, 4 on, 4 off) etc.

6 on, 6 off, 4 on, 4 off, 4 on. (called the Swedish watch)

1 watch: all on, nobody off (called the Chinese-watch)

3 watches system

By separating a 4 hour watch in 2 times 2 hour watches, you can rotate the 4 on, 8 off system. In this way you will have a sunset on one day and the other day the sunrise. A disadvantage of this system is that some people have problems keeping up with their Bio-rhythm.

Example (Stad Amsterdam)

STANDARD ORDERS IN CASE OF FIRE

- Anyone discovering a fire reports this to the bridge immediately and attempts to extinguish the fire with available means.
- Officer of the watch localises the fire and stops ventilation, starts Fire-fighting pump.
Ventilation of E.R. only to be stopped when fire is in Engine Room.
- Fast attack team investigates and tries to extinguish the fire.
If not successful: roll out fire hoses. After that they wait for the fire team in a safe place, and inform the scene leader about the situation (i.a.w. FFTM 1,3 of 18).
- Officer of the watch sounds general alarm and musters crew → *Fire Fighting Training Manual.*
- Chief Engineer takes charge of fire fighting from the chart house.
All communications are made through Chief Engineer.
- FT 1 + FT 2 prepare for fire fighting directed by scene leader.
- Boundary-man closes/ opens hatches, directed by Chief Engineer.
- Apprentice engineer disconnects mains, operates SOS-valves and applies CO₂ directed by Chief Engineer.
- All passengers and non-assigned personnel assemble at the port side of the main deck for mustering.
- Non-assigned report at the charthouse afterwards.

EMERGENCY RESPONSE TEAM

2 WATCHES

date

EMERGENCY SIGNAL: Continuous Bell + PA-call
ABANDON SHIP SIGNAL: 1 long and 7 short Bell

NOTE: LAUNCHING OF LIFEBOATS & RAFTS ON COMMAND OF CAPTAIN ONLY
NOTE: RELEASE OF CO2 IN ENGINE ROOM ON COMMAND OF CAPTAIN ONLY

position

Rank	Name	Emergency function On watch	Emergency function Off watch	Abandon ship function	Sit. A	Sit. B	Sit. C	Sit. D
1	Captain	Command overall	Command overall	Command overall	25	30+28	26+66	26+124
2	Chief Engineer	Head Leader	Head Leader	Head leader	Lifeboat	raft 3/4*	raft 4*	raft 6*
3	tba	Boundary team	Boundary team	Prepare lifeboat	Lifeboat	raft 3/4	raft 4	raft 6
4	1st Officer	Officer on watch	Sceneleader FT White	Muster crew / Medical team	Lifeboat	raft 1/2*	raft 3*	raft 5*
5	2nd Officer	Officer on watch	Sceneleader FT Red	Logbook etc.	Lifeboat	Lifeboat	raft 2*	raft 4*
6	(3rd Officer)	Officer on watch	Messenger/ Supply	Epirb, Sart, Rockets in lifeboat	Lifeboat	raft 1/2	raft 1*	raft 6
7	Bosun	Boundary leader	Boundary leader	Prepare and launch lifeboat	Lifeboat	Lifeboat	Lifeboat	lifeboat
8	Quartermaster	Fast attack; 1st nozzle FT red	1st nozzle FT Red	Prepare lifeboat	Lifeboat *	Lifeboat*	Lifeboat*	Lifeboat*
9	Quartermaster	Fast attack; 1st nozzle FT white	1st nozzle FT White	Prepare slide & rafts	Lifeboat	raft 3/4	raft 4	raft 2*
10	AB	Fast attack; 2nd nozzle FT red	2nd nozzle FT Red	Prepare slide & rafts	Lifeboat	raft 1/2	raft 1	raft 3*
11	AB	Fast attack; 2nd nozzle FT white	2nd nozzle FT White		Lifeboat	raft 3/4	raft 3*	raft 6
12	AB	Hose / Hydrant FT red	Hose / Hydrant FT Red	Guide passengers	Lifeboat	raft 3/4	raft 4	raft 1*
13	AB	Hose / Hydrant FT white	Hose / Hydrant FT White	Guide passengers	Lifeboat	raft 1/2	raft 1	raft 6
14	OS	Helper FT red	Boundary team	Guide passengers	Lifeboat	raft 1/2	raft 2	raft 6
15	OS	Helper FT white	Boundary team	Guide passengers	Lifeboat	raft 3/4	raft 2	raft 6
16	tba	Spare FT	Spare FT	Supply food	Lifeboat	raft 3/4	raft 2	raft 6
17	Hotel Manager	Muster leader	Muster leader	Supply food	Lifeboat	raft 1/2	raft 4	raft 6
18	Executive Chef	Asst. muster leader	Asst. muster leader	Muster leader	Lifeboat	raft 1/2	raft 1	raft 6
19	Head Housekeeping	Medical team	Medical team	Asst. muster leader	Lifeboat	raft 3/4	raft 3	raft 6
20	tba	Distrib lifejackets reception	Distrib lifejackets reception	Medical team	Lifeboat	raft 3/4	raft 3	raft 6
21	tba	Distrib lifejackets midships	Distrib lifejackets midships	Distrib lifejackets reception, surv suit	Lifeboat	raft 3/4	raft 3	raft 6
22	Bartender	Stairway guide reception; Sweep	Distrib lifejackets midships	Distrib lifejackets midships	Lifeboat	raft 1/2	Lifeboat	raft 6
23	tba	Stairway guide reception; Sweep	Stairway guide reception; Sweep	Stairway guide reception; Sweep	Lifeboat	raft 1/2	raft 1	raft 6
24	tba	Stairway guide midships; Sweep	Stairway guide midships; Sweep	Stairway guide midships; Sweep	Lifeboat	raft 1/2	raft 2	raft 6
25	tba	Stairway guide forecastle; sweep	Stairway guide forecastle; sweep	Stairway guide forecastle; sweep	Lifeboat	raft 3/4	raft 3	raft 6
26	Doctor	Guide Pass. - Medical team	Guide Pass. - Medical team	Guide Pass. - Medical team	Lifeboat	raft 1/2	raft 3	raft 6
		Medical team	Medical team	Medical team	Lifeboat	Lifeboat	Lifeboat	Lifeboat

* = raft / lifeboat leader and takes VHF Ch 17 + spare battery
LAUNCHING Lifeboat: Bosun & # 3 + Shift on watch launch lifeboat. shift not on watch crew lifeboat/RIB.

From:	LT=UTC +/-	Date and time of departure:
To:	LT=UTC +/-	Date and time of arrival:
Distance: NM	SOA: kn	Transit time: h

Local time must be checked on daylight saving time.

Charts (BA)

Number	Cor. Y/N	Number	Cor. Y/N	Number	Cor. Y/N	Number	Cor. Y/N	Number	Cor. Y/N	Number	Cor. Y/N

Route GPS	Nr:	
Plot intervals		
Navtex & Nav. Warnings	In Voyage Prep. (Y/N):	In Chart (Y/N):

Tide Reference book	Port of departure at ETD	Port of arrival At ETA
HW		
LW		
Current at harbour entrance		
Direction	°	°
Speed	kn	kn

Put the following in the chart:

- Waypoints & Track
- VHF Channels calling in points

Weather forecast

Navtex	
Other sources	



5.3 MAKING SAIL

1 In General

2 Sail by Sail

1) In General

In general sail-setting is easier than sail-shortening. Make sure that you are able to take a sail away before you set it.

A number of sails are bent on to a fixed yard, others are on running yards. The advantages and disadvantages of fixed and running yards are addressed later in the reader.

Some important commands:

Let Go! (Lekko!)	Letting go of a line but staying in control. (also: "Lekko SB Anchor"!) Ease Away, Pay out!
Cast Off	Slow controlled easing of the line.
Come up	Take the line off the belaying-pin or from the bitts. When belaying, drop the line so the person closest to the belaying pin can belay the line.

The place where to belay the lines has already been discussed in chapter 4.4. After setting a sail, belay only the lines that have to be belayed. Leave the rest on deck. After all the necessary sails are set we then clear the decks. Quite often lines have to be readjusted after all the sails are set. It can be irritating if you have to drop nicely coiled lines onto the deck again because you want to adjust them a little. Also buntlines have to be overhauled in the rigging and the lines should not be belayed before that is done.

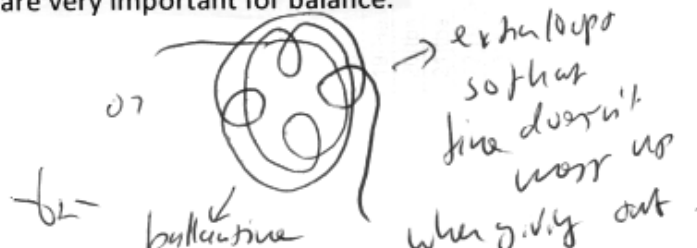
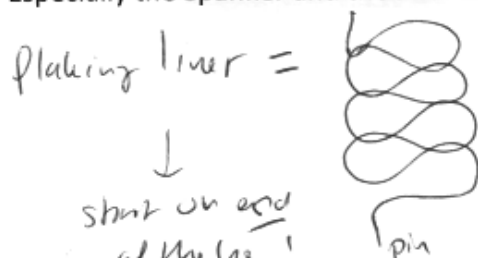
Sail in its Gear, to cast off the Gaskets you have to climb the rigging; when gaskets are taken off they should be coiled nicely and hung on the front of the sail. Make sure that you do not forget a gasket. If you hoist the sail in the dark and nobody notices the forgotten gasket the sail can easily be ripped when pulling the sheets tight.

Brace (if possible) a little more square than close-hauled before setting a sail. This makes hoisting easier and the tension on the topmast is a lot less.

Ease the Braces, in case of running yards the braces are coming tight when the yard is being hoisted (angle of the braces is changing). This has to be done with care so that the braces are not becoming too slack and the yard starts swinging. Make sure when setting sail you keep the yards a little more square than necessary. Bracing more square later needs more people (power) than easing the windward brace a little and take the slack on the leeward brace. *earlier to go from square to close hauled*
the vice versa

In principle, both clew-lines are eased at the same time and the sheets pulled home. If there is not enough crew to do this in one go, you should slack the leeward clew first and pull the leeward sheet home. This way the wind is not billowing the sail and doesn't give extra heel to the ship and a lot of tension on the buntlines. For setting the Courses you should act the other way around, because you want the windward leech as tight as possible.

In a normal sail setting situation the sequence will be as follows: Lower topsails - Upper topsails - Topgallants - Royals. Then we decide if we first set the Fore-course or the Main-course, this depends on our wind sailing angle. Downwind = Fore-course first, otherwise the Main-course first. It is all about the balance of sail. Make sure you can still manoeuvre the ship while setting sail (without the use of the engine). This means, that while we are setting the squares, also the fore and aft sails have to be set. Especially the Spanker and the Jibs as they are very important for balance.



Overhauling the Buntlines, when the sail is set the buntlines have to be overhauled because the weight of the lines to the deck pulls the foot of the sail up. You have to climb the rigging for this. There are 2 ways of overhauling. a) You make a bend in the down running part of the buntline where it leaves the block to run to the deck. Tuck this bend into the strop of the block in a way that when you give a pull on the buntline (from the deck) it will come loose without any problem. b) You can also take a piece of cotton thread (rotten cotton) and tie the buntline up to the block with this piece. When pulling the buntline on deck the rotten cotton will break (not for day-trips but good for trade wind stretches).

If all the sails are set you can start coiling all the lines and clearing the decks.

2) Setting individual sails

See also "commands for sail handling"

Lower Topsail

Sheet home (lower) tops'l.

This is always the first sail to be set, you can set it swiftly because no yard has to be hoisted. Taking away the sail is also a piece of cake, if something is going wrong when manoeuvring in or out of Port.

Let go Buntlines Gordingen los

Ease the Clewlines Geien los

Haul on the sheets Schoten aan

The sail is now set and we could overhaul the buntlines but in general we will wait with this until all the sails that are wanted are set.

Upper Topsail

Set the Upper- Tops'l.

Let go Buntlines Gordingen los

Ease the Downhaul Neerhaler los

Haul on the Sheets Schoten aan → slack sheet & gullies

In some ships the upper-tops'l sheets are shackled to the lower-tops'l yard and the last command **Haul on the Sheets** is not given.

Ease the Braces Vier op de Brassen

By holding the windward brace tight and slacking away the leeward brace, the sail already gets some fanning whilst being hoisted.

Hoist the Uppertops'l Hijs de Bovenmars

Topgallant

Set the t'gallant Zet de Onderbram

Let go Buntlines Gordingen los

Ease the Clewlines Geien los

Haul the Sheets Schoten aan → slack sheet royal

Ease the Braces Vier op de Brassen

Hoist the T'gallant Hijs de Onderbram

Royal

Set the Royal Zet de Bovenbram

Let go Buntlines Gordingen los

Ease the Clewlines Geien los

Haul on the Sheets Schoten aan → slack sheet of sky sail if there is one

Ease the Braces Vier op de Brassen

Hoist the Royal Hijs de Bovenbram

Courses & Crossjack

Set the Course, Crossjack Zet de Fok, Grootzeil, Begijn

Let go Buntlines Gordingen los

Ease the windward Clew

Loef Gei vieren

Haul on the Tack

Hals aan

Ease the leeward Clew

Lij Gei vieren

Haul on the Sheet

Schoot aan

It is important that "*Ease the windward Clew*" and "*Haul on the Tack*" is happening at the same time otherwise the sail will start flapping and the heavy clew-garnets can become widow-makers. Use the same procedure for the Leeward-Clew and Sheet.

The setting of the Fore & Aft Sails is already discussed in the KZV.

5.4 SHORTENING SAIL

1 General

2 Individual Sails taken in

1) General

You douse, lower or strike a Staysail. Square-sails are clewed up to the yard or to the Bunt, so we speak of shortening or taking away of a Square-sail. One of the big advantages of a square-rigger is she can shorten sail on any course or in any wind force. The weight of the yards will make sure that the sail (including the yard) will come down. Compare a schooner in the same situation, she has to turn into the wind to lower her sails. If a square-rigger would do the same the sails would fall aback and make it even more difficult to lower them. The sequence of lowering sails is opposite to the way we set them, so we start with the highest sail and work downward.

Often when manoeuvring under sail is done, the Courses will be clewed up first. This way it's a lot easier to brace (no sheets and tacks to operate, just the braces) and the view to forward for the Captain is a lot clearer.

The extra command is to prepare the crew for the coming manoeuvres and will sound as *Make ready to.....* after this command the crew will flake or Ballantine the halliard(s) and take the coils off the belaying pins. If that is done the first command will be:

Let go theHalliard and haul away on the Clew-lines.

By pulling the clew-lines they work as a downhaul and they will help pull the yard down. At the same time they will keep the yard in a horizontal position. It is of great importance that the sheets are still belayed and tight. When the yard is resting in her topping-lifts the following command will sound;

Let go Sheets and haul away on clews and bunts.

Now the sheets are cast off and for the second time the clew-lines are pulled, but now they bring the sheet-corners home to the yard-arm or to the bunt. The Buntlines can be hauled at the same time and the sail will come nicely to the yard. If the crew is not big enough to man the windward & the leeward clew and bunts at the same time, start with windward and then clew up the leeward. At the same time somebody mans the braces and takes out the slack while the yard is coming down. This is also the person that is able to see when the yard is resting in its topping-lifts. If that is the case he will call:

Yard in its lifts! The yard is now safe for the crew to enter, but under normal circumstances they wait until the clew-lines and buntlines are home. If you go up to furl the sail make sure, before you leave the deck that the buntlines and sheets have enough slack in them to make furling of the sail possible. If you are going to enter the lower-topsail-yard make sure the two downhauls of the upper-topsail-yard are tight. These two lines keep the yard in a steady horizontal position. This yard doesn't have topping-lifts, remember?

topping lift lowest yard always fixed
- yard is fixed
- we have to align yard with horizon while heeling.
all at once
by -

Furling the sail has the following advantages:

- * Clews & Bunts can stay slack, which makes bracing a lot easier.
- * If you don't know what to expect next concerning the weather you can do the job when the conditions are still nice.
- * Chafe is a lot less when the sail is furled, flapping sails in high winds chafe quickly.
- * Less windage if the sails are stowed properly
- * Better protection against UV radiation.
- * It looks neater although this is a matter of taste of course.

In a "Harbour-stow" extra attention is put to a very neat furl and the advantage is also that rainwater can't get into the furl.

2) Taking-in Sails individually

See also the "commands for Sail handling"

try to slack the sheets of the above sheet about 7m

Royal

Standby Royal

Halliard, Braces, Clew lines, Buntlines & Sheet are being manned.

Lower the Halliard.

Haul the Clew-lines.

Haul the Braces.

When the yard is in her Topping-lifts.

Ease the Sheets & haul the Clewlines.

Haul the Buntlines.

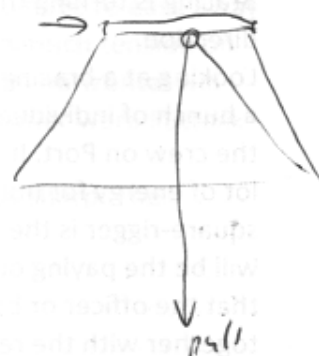
Vier de Boven-Bram val.

Geien aan. → heest de 7m onlay

Brassen aan. → 7m uit 20m

Vier de Schoten en Geien aan (wederom).

Gordingen aan. → 1m 1/2



Topgallant

Standby T'gallant.

Halliard, Braces, Clew, Sheet and Bunt-lines are being manned.

Lower the T'gallant Halliard

Haul the Clewlines.

Haul the Braces.

Vier de Onderbram val.

Geien aan.

Brassen aan.

probably exam question!

When the yard is in her Topping-lifts.

Ease the Sheets & haul the Clewlines.

Haul the Buntlines.

Vier de Schoten en Geien aan (wederom).

Gordingen aan.

lowly sails.

topps lift

Upper-Topsail

Standby by Uppertops'l

Halliard, Downhaul, Braces and Buntlines are being manned.

Lower the Uppertops'l Halliard.

Haul the Downhauls.

Haul on the Braces.

Haul on the Buntlines.

Vier de Bovenmarsval.

Neerhalers aan.

Brassen aan.

Gordingen aan.

Lower-Topsail

Standby the lowertops'l

Sheets, Clew & buntlines are being manned.

Ease away the Sheets.

Haul on the clewlines.

Haul on the buntlines.

Vier op de schoten.

Geien aan.

Gordingen aan.

Slack sheet only when furl the sail
if necessary to do while lowering → slack to lower before.

halyard
- 65 -

low pull



clew

let go of the
pull clew down
leave sheet high
in topping lift
- yard in topping lift
sheet let go
pull clew down again

Courses & Crossjack

Stanby Course / Crossjack.

Sheet, Tack, Clews & Buntlines are being manned.

Clew up Tack and/or Sheet.

Gei op de Hals/ Schoot van Fok/Gr.Zeil/Begijn.

Clews are pulled, tack & sheet are eased away.

Haul on the Buntlines.

Gordingen aan.

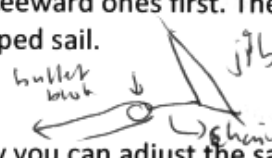
Take special care that the clew-garnets don't become Widow makers.

How Fore and Aft sails are taken away: as discussed in the KZV course.

Take special care with the bullet blocks of the jibs & staysails, widow makers.

When pulling the Spanker brails with lots of wind, pull the Leeward ones first. The windward one will give a billowing sail which makes the job harder and possibly a ripped sail.

another widow maker: bullet block



the last sheet he came of cloth

5.5 BRACING

Bracing is turning the yards in a horizontal plane. In this way you can adjust the sails in regard to the wind direction.

Looking at a bracing crew a captain knows straight away if his crew works together as a team or that he has a bunch of individuals on board that are just pulling the lines. The crew on Starboard has to cooperate with the crew on Port. If the easing crew is holding too much tension on the Braces the pulling Crew is wasting a lot of energy for nothing. If a crew is a team you will see an easy and smooth turning of the yards. A square-rigger is the ultimate tool to make these excellent working teams. Just remember that today you will be the paying out party but tomorrow you will be on the hauling side of the yards. It is also important that the officer or bosun in command knows exactly how the Captain wants the yards to be braced together with the required fanning of the yards for that particular course and wind strength.

A Bosun's whistle or the shouting of commands is one way of getting there but the Dutch way is to be as quiet as possible so that every order can be heard clearly. If a crew-gang is singing shanties and the bosun is crying out commands there is a big chance that the necessary command is not heard by all the crew and that damage is done to the rig.

Some orders;

Bracing Up, Sharpening Up

Aan Brassen, Scherper Brassen.

Bracing In, Squaring Up

In Brassen, Vierkanter Brassen. (Op Brassen)

The Dutch order "Op Brassen" could be confused with the English order "Bracing Up". On ships with an international crew it is safer to always put the word "Squaring" or "Sharpening" in your order.

Brace Square

Vierkant Brassen = (brace the yards square)

Lifting

hullen Levendig houden = (keep the yard-arms in the wind direction)

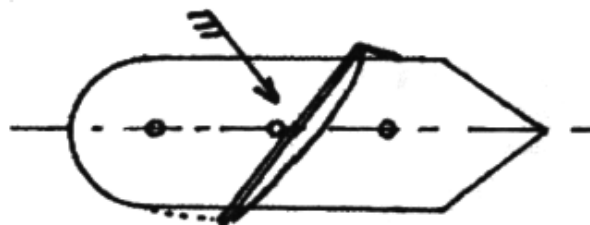
Port Tack

Over BB Hals = (In Dutch the same as over SB boeg)

Starboard Tack

met SB hals toe = (In Dutch the same as over BB boeg)

square might be too back & later i.e. v-boeg in confusion

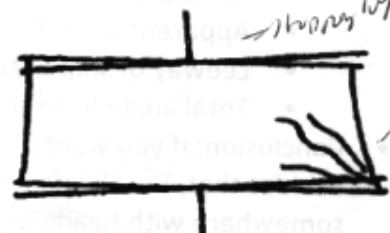
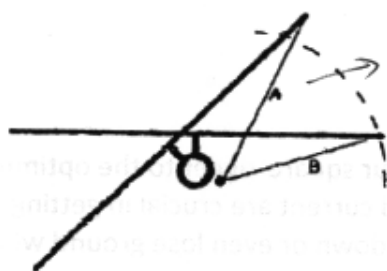


- Make sure that when you hoist the running yards to keep them braced a bit more square than the lower yards. Keep tension on the windward brace when the yard is hoisted. The commanding crewmember should be on this windward brace. He will have a good oversight of the hoisting procedure. If you have to brace in when the sail is set it will be a job that needs a lot of hands.

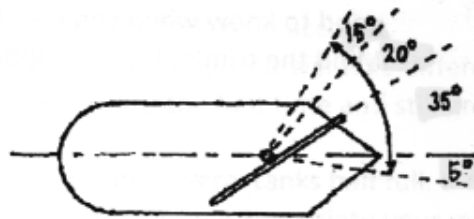
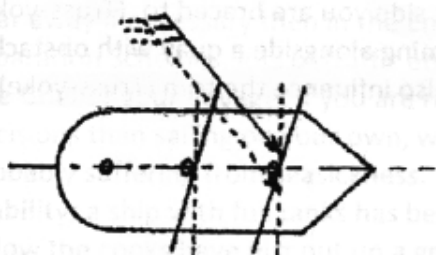
pull leeward
a tilted yard
toppy till before start bracing
bracer sharp
bb-

350
200
150
50

- When bracing around make sure all bunt-lines and clew-lines have enough slack to come around. For the Courses & the CrossJack, make sure the Sheets and Tacks can run out freely. When the sail is furled the Clews & Bunts should already have enough slack.



- When bracing around under sail you should also keep an eye on the running topping lifts of the Courses & Crossjack. The yards should stay in a horizontal position and often you have to ease away the windward topping-lift a little. When bracing sharp you could end up with too much tension on these running topping lifts and this makes bracing very difficult. Keeping the yards horizontal will make sure that you can brace sharper. The leeward yard-arm should be in the corner where Futtock-shrouds and the Lower-shrouds meet each other.
- On many ships you have to attend also the sheets of the squares when you brace sharp. The windward leech of the sail should be nice and tight. So no wrinkles in the sail!
- Belaying of the Braces, one more time:
 - The higher the sail the more aft the brace.
 - The three lowers to the Jarvis-winch or to the Pinrail.
 - Above these three, to the Pinrail or the Fife rail.
 - Crossjack, crossing each other and to the Fife rail
- Take care that during tacking the braces of the Main-top don't get locked in the yards of the Fore-top (after the *Let Go Aft* command). The best way to prevent this situation is to slack the windward braces of the Fore-top a little. The backing of the Fore-top will also become more effective in this way.
- "BIDEVINDSTIK" (a Norwegian term). This is a seizing that works as a mark on the windward Brace so that you know exactly how far you can ease out the brace to get the yard in the close-hauled position. To use these marks properly you should also have a seizing as a mark on the Halliard to make sure the yard is always hoisted to the same position. If that is not the case the "bidevindstik" won't be accurate. If you make the "bidevindstik" of a thicker yarn you can feel it when it passes through your hands in the dark. Also, always put an Able Seaman on the windward braces. If he eases them too much it will take a lot of hands to brace them back again (more square).
- Always keep tension on the braces as they take a lot of the driving power that is given to the sails. When sailing close hauled, if the leeward braces are too slack the yards will back more easily and the helmsman will have trouble to bring the ship back on course.
- Rule of thumb for the bracing position of the yards: Divide the angle between the apparent wind and the heading in two. When the wind is coming more from the quarter you can brace a little more square to reduce the effect of blanking out the other square-sails.

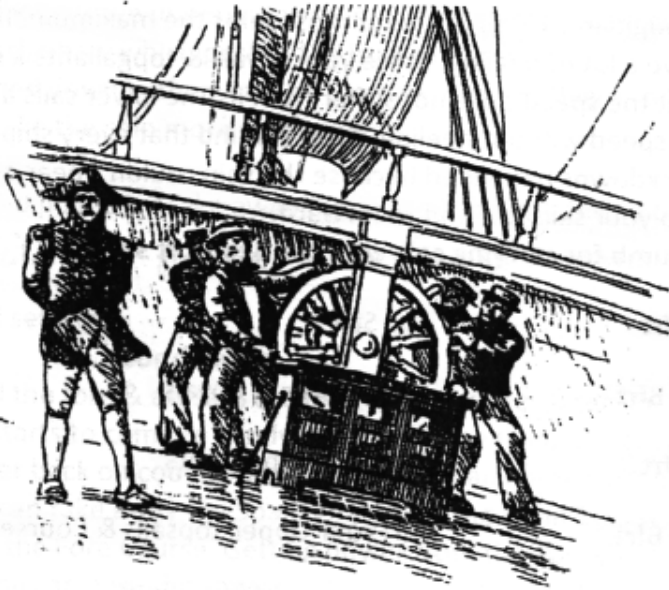


- Sailing Close-Hauled: The maximum brace-angle depends on the rig design but should be around 35° . The stays, backstays and the width of the Truss-yoke. The length of the yards is the leading problem of chafing braces on the backstays.
 - Brace angle around 35° — *limit*
 - Wind angle in the sail 20°
 - Apparent wind 15°
 - Leeway of ship 5° to 10°
 - Total angle from the true wind = 75° to 80°
- Conclusion: if you want to sail into the wind you need to trim your square-rigger to the optimum. Besides that, the Helmsman and a sharp eye on the weather and current are crucial in getting somewhere with headwinds. Otherwise you will just sail up and down or even lose ground while tacking.
- Sailing Close-Hauled your highest square-sail may lift a bit (skysail or royal); this is to keep a steady wind angle. If you keep all your sails full you will gain speed and your relative wind will increase and bring the apparent wind more forward again. In this way it looks you are doing fine but in the meantime you are sailing nearly with a beam wind which brings you nowhere. A rule of thumb is that the close-hauled speed is half of the speed you could get with the ship reaching with that same wind force.
- Fanning or Twist: As a consequence of the difference in wind strength between the sea-level and for instance 30 meters above that level. The apparent wind angle will also be different high in the rigging compared to the wind blowing into the courses. That is the main reason that the yards are fanned. The higher the yard, the squarer it will be braced.

Why Fanning:

- 1) With a stronger wind the waves will give more resistance to the wind and by doing so, the difference in angle of the higher and lower winds will be bigger (=more fanning).
- 2) With a heeling ship less pressure on the higher sails is recommended (=more fanning).
- 3) If the Royal or Skysail is close to lifting and all the other sails are still filling nicely, = fanning.
- 4) In a way, the fanning starts already on the courses where the tack of the sail is forward of the yard and the sheet is pulling the leeward part of the sail behind the yard. Fanning makes it easier to have a really tight windward leech, which is important to sail close to the wind.
- Fanning will be around 15° difference between the lower yard and the skysail yard and quite often it will be less. Keep in mind: when is the difference between True and Apparent wind the largest?
- How the yards are braced in a fanning style depends on how you sail the ship. On some ships you will find the topsail-yards braced even sharper than the lower-yards. By doing so the goal is to sail closer to the wind. Sometimes you will find out that the skipper wants the yards straight above each other. Ship & Skipper are leading in all this. In a race between Tall ships the real winner will be found.
- Yards with no sails are braced in a way that they catch as little wind as possible. Yard arms point in the wind direction.
- Be aware of your yards when manoeuvring with the ship alongside!
 - In general brace in the same way as the ship you are going alongside to.
 - The yards stick outside the ship less on the tack side you are braced to. (Truss-yoke) This is good to know when you pass bridges or are coming alongside a quay with obstacles.
 - Mind the trim of the ship. Bracing around will also influence the trim (Truss-yoke)

- While manoeuvring under low speed it is important to have as little windage as possible. In windy situations it is advisable to keep the crew on the braces and give them the order to keep the yards lively. → make a turn → keep the yards h/l or v/l → use braces



5.6 CARRYING OF SAIL

1 Carrying of sail in the light of wind strength and crew

2 Carrying of sail in the light of different courses

3 Changing course

1) Carrying of Sail in the light of wind strength and crew

There are many factors leading to which sail to set.

Some of these factors are:

- **The Weather:** we have obviously more possibilities on a square-rigger then on a fore & aft rigged vessel. We have 2 or 3 or more masts with each of them carrying up to 5 sails and depending on the wind we can decide which and how many of the sails are set.
- **The weather forecast:** we need to keep in mind that taking away sails will take some time. So if you expect showers make sure the sails are taken down and furled before the showers reach the ship. Also, in dark conditions it will take longer and showers are not always visible on the horizon. Use your radar to track them and give the crew time to get into their proper clothing & harnesses! Be careful with the first shower or squall, you do not know what kind of wind changes it will bring you. Furl, in time, all fair weather sails and make sure you are carrying sails that allow you to bear away even in high wind forces.
- **The Crew:** with a well-trained crew you can get more out of your sailing then with a new & inexperienced crew. Shortage of hands on deck is also a factor you have to keep in mind. Give them the time they need for shortening sail!
- **The waters you sail in:** in the middle of the Atlantic Ocean you have more room to manoeuvre and bear away if necessary then in the English Channel with hazardous Islands, Tidal currents, Traffic Separation Schemes, lots of traffic etc. Also the visibility is a factor to take in account.
- **The Goal of your voyage:** if you are racing with other Tall ships close by, you will take different decisions than sailing on your own, with trainees that are on board the first time and still green and probably suffering from seasickness.
- **Stability:** a ship with full tanks has better stability than a ship with several tanks half full. If down below the cooks have just put up a grand buffet for their guests they will appreciate your modest sail setting. Also if you are sailing with the elderly or people with disabilities, modest sail setting is appreciated.

- **Sea-state:** if you are sailing straight into an old swell the forces in the rigging can be tremendous. Also take care when your ship is rolling severely: adjust your sail setting or find another course.
- **Heeling:** More sails set will give more heeling. In contrast with a classic yacht the waterline of a square rigger will not become a lot longer when heeling. In general you can say that 10° of heeling is good enough and 15° to 20° is for most ships the maximum. If it becomes more: shorten sail. High staysails give a lot of heeling. Brace your royals & topgallants a bit more square (Fanning) and you will see that the speed does not suffer from it. The lower sails are in a better position to give you power and speed without heeling. Keep in mind that every ship will react differently. Most of the recent knockdowns happened because the ship couldn't bear away anymore after a large heeling angle! Keep your sails low and to forward.
- **Rules of thumb for carrying sail with the Beaufort scale:**
 - **4 Bft** Full Sail
 - **5-6 Bft** furl Skysails & Royals
 - **7 Bft** furl your Topgallants
 - **8-9 Bft** furl your Upper-topsails & Courses
 - **11 Bft** furl you Lower-topsails

Your lower topsails are your storm-sails, besides some storm-jibs and a try-sail on the spanker boom. With these sails you have to bring the ship in balance on a course where she will take a heave to position in comfortably. Another option is to run before wind & sea if you have the sea-room. Then the fore-lower topsail and one or two storm-jibs and or staysails have to do the job.

Keep in mind that these are all rules of thumb and that every ship reacts in her own way and needs her own way of handling.

2) Carrying of sail in the light of different courses

A square-rigger is the ultimate sailing ship for following winds. Even down wind is no problem, in contrast with schooners that always have to be on guard for a (unwanted) gybe.

Whatever course the ship is sailing is has to be in balance, in other words not too much "weather helm" and no "lee helm". In the past deep water sailing ships had small rudders that were there to make only small corrections. Nowadays deep water sailing ships also have engines and they need a larger rudder for manoeuvring in port.

more than 50° helm → do something about your sails

We have two concepts to look at:

1. **Balance:** carrying the sails that give the ship a steady course with little rudder correction (weather helm). We can adjust the balance by setting the right sails. In other words before or behind the Lateral Point.
2. **Trim:** the right trim of the sails for the wind that we are experiencing. This is done by braces and sheets. In general you can say that the squares are there for propulsion and the jibs and staysails for balance. Always start with finding the correct balance and then start trimming. An example of trimming is sheeting out the spanker a little if the weather helm becomes too much. You can do the opposite by easing the jibs sheets. Realize that taking away a sail could be a better solution. A sailing ship should carry a little "weather helm" this means that the Sail point is situated a little before the Lateral point, this is called "the lead".

*lee helm: put helm to lee → move to wind
weather helm: " " " / 1/2 → move to lee*

*weather helm: 10° giving
lee helm: 15° giving*

A ship will go to windward if:

- The ship starts heeling. The point of buoyancy moves outside of the line of keel to leeward and creates a large windward lever.
- If you change the trim of the sails with the sheets and braces or by setting or taking away sails
- The heeling of the ship also changes the underwater shape of the ship and causes a little hill of water on the leeward side of the bow which pushes the bow to windward.
- If the head of the ship is pushed down in the water by the power of the (high) sails the lateral point will move forward and will make the ship more weatherly.

The solution for all 4 above mentioned points is "Take away the main royal" and the ship will be easier on the helm again.

Take away sail that pushes to windward: staysail / sprake / etc.

Different courses have their own sail setting.

- **Running**

Voor de wind

In principle only with square sails. All the fore & aft sails are furled, except the Outer Jib, as a precaution. If the ship runs out of her rudder and starts to come to windward rapidly the filling Outer Jib will give the man on the wheel a chance to get her back on course. If the masts are blanketing each other this is not effective for course and speed. You can take away the Spanker and put the Main Course in her clew & buntlines so that the wind can reach the Fore Course. Getting power from the Fore Course will make it easier to keep the ship downwind. You can ease the sheets of the sails in the fore top a little so that the sail gets a little more lifting power. This is also the course to set studding sails on both sides of the Fore Top.

- **Quarter wind**

Ruime of Bakstag wind

This is one of the most favourable winds. All the sails are filling, the yards are braced up a little (not too much so that the blanketing effect does not becoming a factor). If the ship becomes too weatherly you can furl the Spanker, Gaff-topsail, or a Mizzen-staysail. Studding sails can be carried on the Fore-top windward side and on the Main-top leeward side.

- **Reaching or Beam Reach**

Halve wind

Often this is the fastest course. All standard sails can be set.

- **Full & By or Close Hauled**

Vol & Bij of Hoog aan de wind

Normally the ship will sail **Full & By**, the ship is sailing with its best sails set in the direction of the wind. (VMG beat). The lower yards will be braced as sharp as possible so that they nearly touch the backstays. If you pull the yards into the backstays you can probably sail a little closer to the wind but you put extra tension on the standing rigging and you cause more chafe. However it can be the captain's decision to do so in certain circumstances. The other yards are in a fanned position. Make sure that the staysails sheets are not too tight. You are not sailing as high to the wind as a schooner so your staysails and jibs should just be full but close to lifting. In some ships certain staysails are not set between the tops because they disturb the wind going to the square sails. The squares are the driving power of the ship! Sailing Close Hauled requires experience and craftsmanship and besides that the continuous concentration of the man on the helm. There is an optimum angle with the apparent wind and this will change for different wind strengths, but also for every ship.

A rule of thumb is that the ship will sail half the speed sailing Close Hauled as she would do Reaching with the same wind strength. If the ship is slower you are steering too close to the wind and the ship will have a lot of leeway, if you are sailing faster you are steering too low. Keep the royal just "stalling". **The officer of the watch has to keep a close eye on the helmsman, the royal and the ship's speed!**

*→ keep
litter on*

3) Changing Course

Changing course means you have to change how your sails are set and after that you use the helm to get there.

1. Come up, Luff up (Op) Loeven
2. Pay off (Af) Vallen

Keep in mind that changing your course will not only give you a different apparent wind angle but also a different apparent wind speed. Luffing will increase the apparent wind speed.

Example:

A square-rigger sails down wind and makes about 10kts. If the True wind in this case is 25kts (6 Bft) then the Apparent wind on board will be 15kts (4Bft). When the ship starts luffing to a Beam Reach, the speed of the ship will increase but also the wind speed will increase from force 4 to 6 Bft. You have to realize that your sail setting should also change. In this case the Royals have to be furled. You should do this before the luffing manoeuvre starts. In the opposite case you are sailing on a Beam Reach and the wind is suddenly increasing. Paying Off to a Running--course will make sure that your apparent wind will drop straight away.

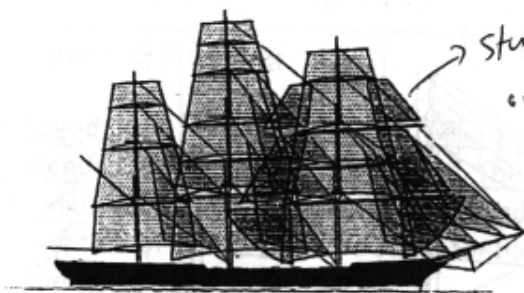
If you Pay Off to go on a Running course it is not only the apparent wind that gets less, also your sails blanket each-other and you lose 2/3 of your sail-area and this brings your speed down even more. In this situation you can make the necessary sail changes. There is no risk of gybing, a danger that a schooner would have in this situation. A bark should get rid of her Spanker in this situation. Paying-Off is the usual emergency manoeuvre for square-riggers when the wind suddenly increases.

paying off not always good manoeuvre ↓ luff up → spilling the wind
can be better still.

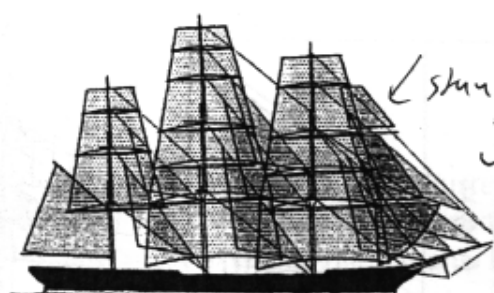
From Teenstra, the Clippers

If a Captain from a normal deep water vessel got the command of a Clipper-ship, he had to bear a few things in mind. There was the large sail area and the sensitivity of these ships, with very fine underwater lines. On a normal ship he would pay off for an oncoming squall. For a Clipper-ship this was quite a dangerous manoeuvre. A close-hauled sailing Clipper with her slender shape, the high and spaciouly placed tops, carrying long yards, would catch a lot of wind when she'd pay off for a squall and receive the increasing wind on her beam. The heeling of the ship would make the small rudder useless and a knock down situation is created. Even if the crew was able to throw of the halliards, the yards would probably not come down because of the heel and the windage. All of this would lead to considerable damage to the rig. You should think of blown out sails, broken yards and topmasts. A racehorse needs different handling than a work horse or even a carriage horse. Clipper Captains used to steer their ships through squalls by luffing and keeping the sails alive. They had to be very careful that the sails did not back because that would be an even bigger disaster. They were 'shaking the squall out of their sails' and this was a job that could only be done by a Captain that knew his job and his ship thoroughly. The Captains that achieved remarkable results with their Clippers would probably also get a lot more out of any other ship than a regular Captain. A great navigational knowledge, inexhaustible energy, a dynamic personality, physical courage, decisive decision taking, a hand full of good luck, besides a ship made for fast passages, those are the ingredients that successful Clipper Captains needed. Only a man born under a lucky star with exceptional physical and mentally qualities will succeeded in successfully commanding a Clipper ship.

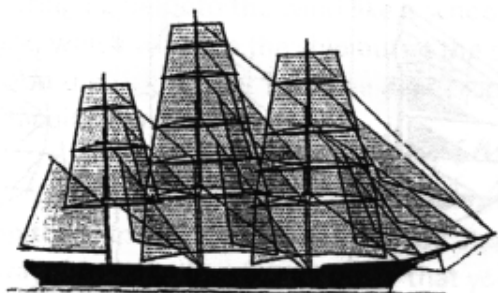
SAIL (AREA) COMBINATIONS



Running: 2195 m2



Reaching: 2058 m2



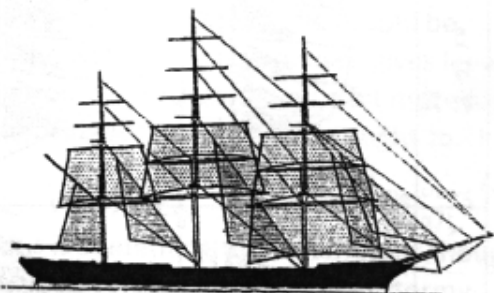
Windward: 1899 m2



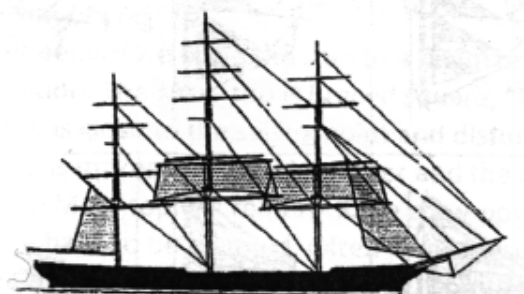
First reef: 1601 m2



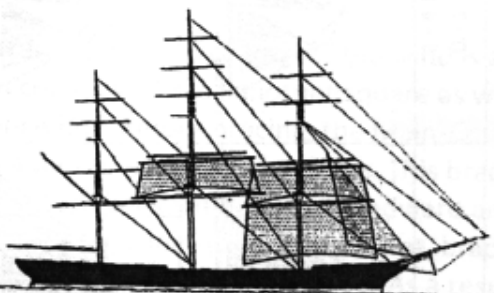
Second reef: 1350 m2



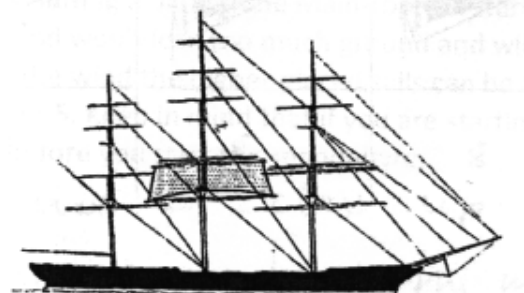
Third reef: 931 m2



Storm windward: 300 m2



Storm running: 413 m2



Survival: 85 m2

example
This is just for Star Quaker
not generally for all ships.

GUIDANCE
for max. sailarea

wind speed app. wind angle	0-16 kn. 0-4 B.	17-27 kn. 5-6 B.	28-33 kn. 7 B.	34-47 kn. 8-9 B.	48-55 kn. 10 B.
40°					
60°					
90°					
120°					
180°					

See special wind sheet with all sails set. H. 1000 (1000)

CHAPTER 6 DIFFERENT MANOEUVRES UNDER SAIL

Reducing Speed & Stopping

in Hatzelhoff Ruffenau is her
decidable ungeduld.

Reducing Speed:

Reducing speed can be done by taking in sail. The speed of a square-rigger can be very well adjusted by setting or furling sails. There are plenty of possibilities. Rule of thumb is that every sail represents 1 knot, with the exception of the Royals who stand for half a knot or the Courses who can do more than a knot. All this is relative of course.

The first and easy way of reducing speed is clewing up the Main-Course and possibly also the Fore-Course. This is an easy manoeuvre that can be done in short time. Keep an eye on the balance of the sails. Stopping the ship by bringing her into the wind like a schooner is not recommendable for a square-rigger. The sails will fall aback, which will stop the ship but at the same time she becomes un-maneuvrable. Also you will bring forces on the rigging that could be dangerous, especially with strong winds. If the sails are aback it is also very difficult to take them away.

Stopping:

You can stop the ship by bracing the Main-top aback. Most of the time you will clew up the Main-course and take away the sky-sail and royal. After that you will brace the topgallant and topsails aback. Through these backing sails the ship will lose speed rapidly and will stop after a minute or two.

To Come to, Brought to, Heaving to: (Bijdraaien)

When a ship has to be stopped for a longer period of time she will be "Brought to". This could be performed if awaiting a pilot or to lower one of her boats into the water. This manoeuvre gives leeway and a steady ship, due to the pressure of the wind which is coming from the beam or even a bit more forward. This manoeuvre is given many names in English: **to come to, to bring to, to heave to, brought to.** i (Bijgedraaid liggen).

Often this manoeuvre is mistaken for "Lying to" (Bij Liggen). This is something totally different though. "Lying to" is done in heavy weather and there are no sails aback, that would not be wise in stormy weather. The misunderstanding starts because in the English language both manoeuvres are called

"Heaving to". → here used
Heaving to

in a storm no backing sails → too much force
here was!! an alle zailen

For this manoeuvre we bring the ship to a beam reach or full & by. The bow 6 points off the wind is a good starting position. The Main-top is braced square, "Lifting". You could also brace another square as well but the Main-top is close to the sailing point and disturbs the balance less. Before bracing, the Main-Course is clewed up, this makes bracing a lot easier and the captain has a better view over the decks. This bracing square of the Main-top will require some crew-power because all 5 braces, on both the windward and leeward side have to be manned. Often it will be sufficient to brace the Main-top square, if not, brace a little further until the whole top is backing. Through this action the ship will come to a stop. As a result the rudder does not work anymore and you have to balance the ship with the sheets of the jibs and the spanker. The ship will find a sort of balance and when she drops away from the wind a little, she will gain speed, start luffing a bit and the Main-top will start backing and stop her. The ship will make a kind of zig-zag course and won't lose too much ground and will be under control at all times. Depending on the strength of the wind the higher placed sails can be taken away. It is advisable that you furl the main royal if it is force 4 or 5. Keep in mind that if you are starting with a running wind you will probably have to take away sails before you start this manoeuvre.

— mop → — clew up courses → give people a job
+ sight + reduce speed
— bracing the main top aback → lots of power to
do so →
keep people busy.

Commands for "Heave to":

Standby to Heave to

Clew up the Main-Course

Brace back the Main mast

Ease out the Heads'ls.

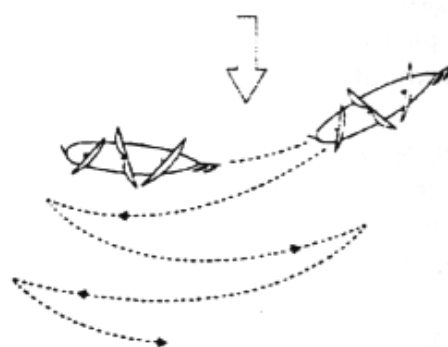
Klaar maken om bij te draaien.

Gei op het Grootzeil.

Bras vierkant de Grote Mast.

Vier op de Voorzeilen.

important
to find
balance →
eilpunt



WEARING → "gijpen bis langzaam"

Wearing, (Halzen) is the manoeuvre to bring the ship onto the other tack by "Paying off" to down wind and then "Coming up" again on the other tack. This manoeuvre has the advantage over Tacking that you can wear a ship under all circumstances. When tacking fails because of too little or too much wind or when there is a big sea running, wearing is a good alternative. The disadvantage is that you lose quite a bit of ground through this manoeuvre. The loss of ground can be reduced by doing it in a proper and smooth way. In this case you won't lose any more ground than during a badly carried out tack. With tacking ground is often lost because the ship starts to make sternway when she comes in to the wind. Wearing is a safe and easy manoeuvre, no flapping sails or sheet blocks and every step of the manoeuvre is easy to perform even with an untrained crew.

The manoeuvre step by step:

Standby/Ready for Wearing

①

Klaar om te Halzen

Everybody goes to his station. Braces are flaked down on the deck, so that they can run out freely when bracing around. Make sure the ship sails very close to the wind and has little speed.

②

→ spanker needs to gybe and is in helplessly

Clew up the Main, Brail in the Spanker.

Gei op het Grootzeil, Strijk de Bezaan.

The Main-Course will be clewed up, so that we don't have to man the tacks and sheets. In this way we have a better view and the sail can't hold up the manoeuvre if it gets stuck behind something on deck. We don't need speed in this manoeuvre. The Spanker is brailled in, so that the ship pays off more easily and it means we don't have to gybe the spanker. We leave the Fore-Course set.

→ helm steer van windward → duwde

→ pressure on fore ship!

Helm Up, Brace and lift aft

③

Roer aan boord, Bras levendig achter

The ship will now Pay Off because of less pressure on the aft end of the ship and through the rudder. On a Full-rigged vessel the Mizzen and the Main-top will be braced lively, on a Bark only the Main-top. In other words: the yard-arms are pointing in the wind direction and in this way the windage of yards & sails is kept at a minimum. While the ship is coming down wind we keep on bracing until we are braced close-hauled on the other tack.

④

Brace up Fore

Bree voor

When the ship arrives on the downwind course we can brace the fore-yards square. This gives room to brace sharp on the main and mizzen. Otherwise there is a risk that the main yards get tangled in the fore-yards (the yards are locked). At the same time we can bring the stay-sails & jibs to the other tack.

Haul out the Spanker

When the stern passes through the wind the Spanker can be set again so that it pushes the ship to windward.

Brace around Fore

When the ship is coming up to the wind nicely the Fore-top can be braced around to the close-hauled marks.

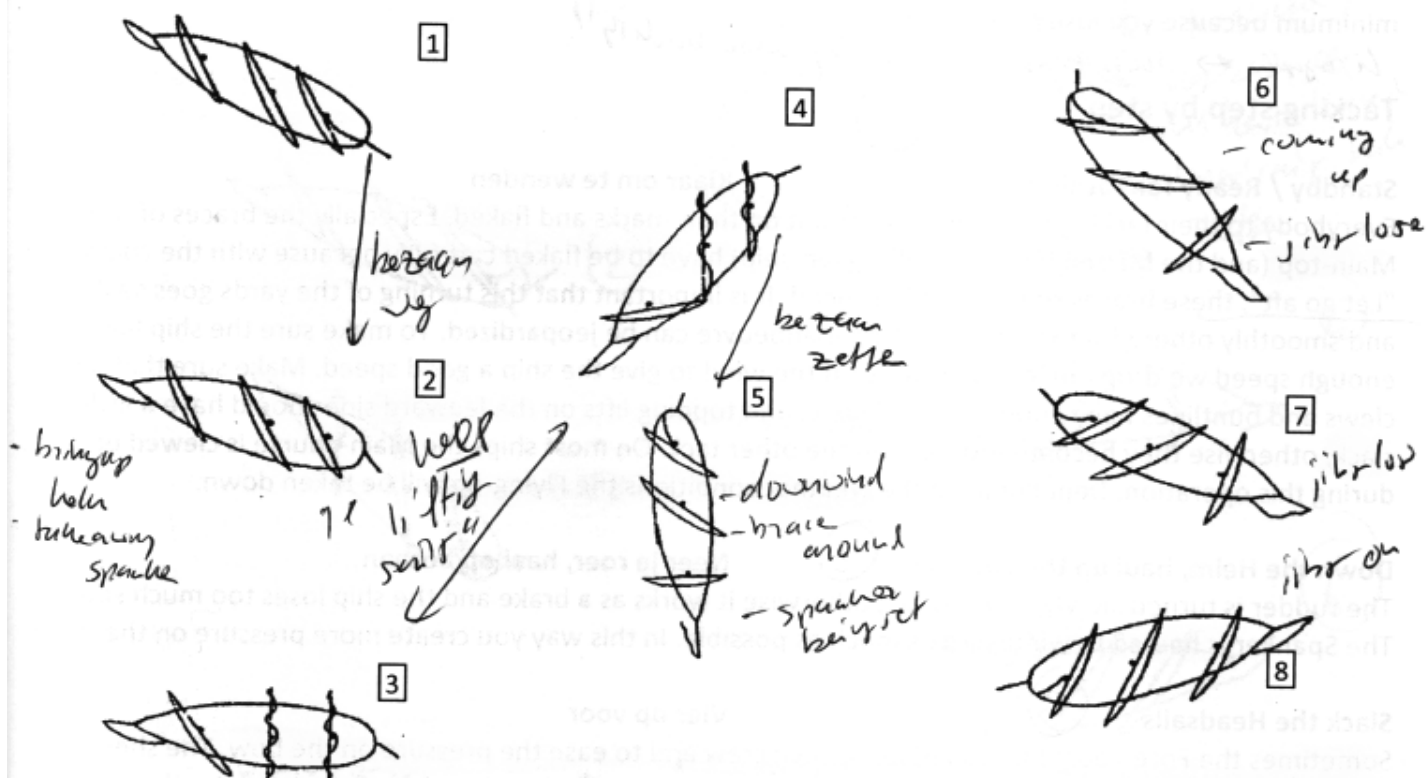
Full and By

The Main-course can be set again and all the yards are trimmed in a sharp fashion. The Topping lifts need to be checked, and the buntlines need to be checked if they still have enough slack in them. After this the decks can be cleared.

Zet de Bezaan

Rond Voor

Vol en Bij



TACKING

door de wind / overstag gaan

Tacking, (Wenden) is the manoeuvre to bring the ship to the other tack by turning the bow through the wind. This manoeuvre is not possible under all circumstances. The sea or swell should not be too big, you need enough wind but also you should not have too much wind. On the moment that the bowsprit is pointing into the wind all the sails are backing. The pressure of the whole rig is now on the Fore-stays and these are not made to carry this load if it is blowing hard. You can decide to take in the royals in order to ease this pressure. In contrast with "Wearing" this "Tacking" manoeuvre can fail. To tack properly you need enough momentum to turn the bow through the wind. Speed is important. Not enough speed will result in making sternway (~~down~~ ^{plein teer}) and possibly in "missing stays" or "in irons" and then it becomes very difficult to manoeuvre. Another cause for getting "in irons" can be: orders not being given at the right time or not being followed up promptly. (Bracing too late or too early). A lot of square-riggers get some sternway while they are tacking, depending on the sea-conditions, but you should try to keep it to a minimum because you lose ground through this.

U rijdt \rightarrow sails niet erg weg when backing!

Tacking step by step

①

Standby / Ready for Tacking

Klaar om te wenden

Everybody to their tacking positions, braces put on their marks and flaked. Especially the braces of the Main-top (and the Mizzen if she is a full-rigged ship) have to be flaked carefully because with the command "Let go aft", these braces run out at high speed. It is important that this turning of the yards goes swiftly and smoothly otherwise the whole tacking manoeuvre can be jeopardized. To make sure the ship has enough speed we drop one or two points off the wind to give the ship a good speed. Make sure that all the clews and buntlines have enough slack. Sheets and topping lifts on the leeward side should have a little slack, otherwise they become too tight on the other tack. On most ships the Main-course is clewed up during this operation. Depending on the weather conditions the Flying-jib will be taken down.

Down the Helm, haul up the Spanker

Neer je roer, haal op bezaan.

The rudder is turned slowly, not too fast otherwise it works as a brake and the ship loses too much speed. The Spanker is hauled to windward as much as possible. In this way you create more pressure on the stern.

Slack the Headsails

Vier op voor

Sometimes the Fore-course is clewed up to save crew and to ease the pressure on the bow. The sheets of the headsails are eased until they lose pressure but not so much that they start flapping violently. Keep an eye on the widow-makers! (Bullet blocks)

Let go Aft

Gaan Achter

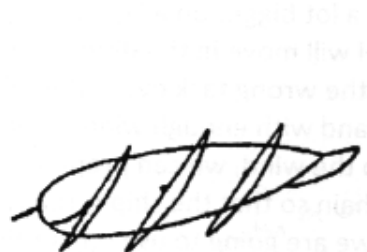
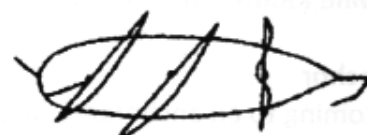
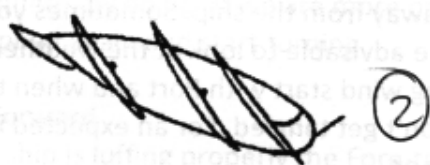
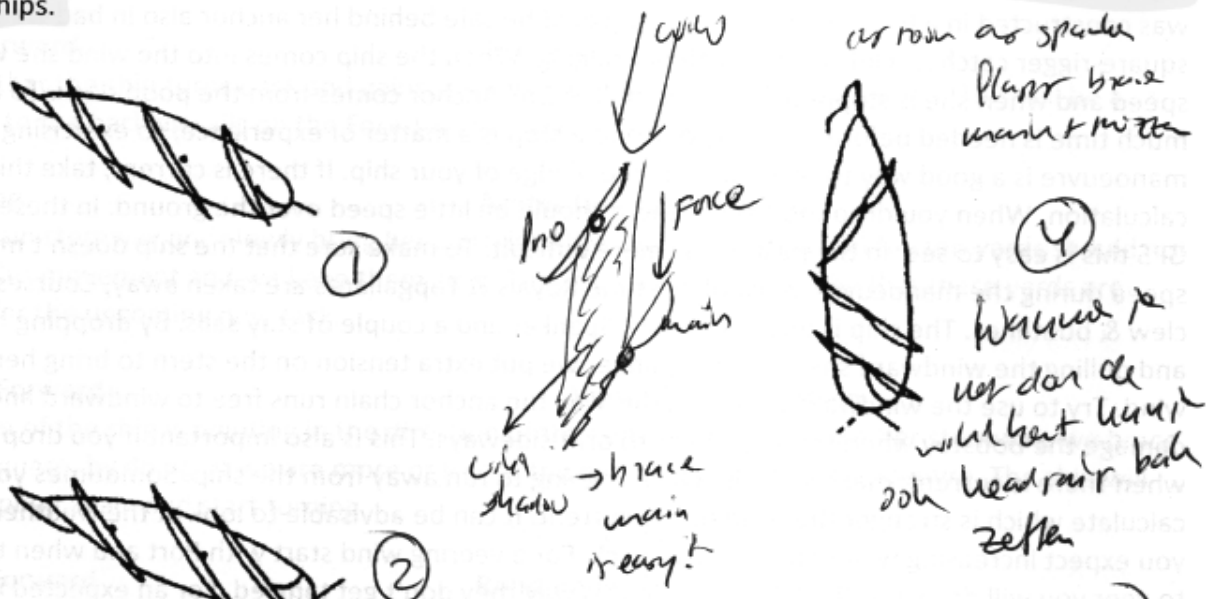
Just before the ship is pointing straight into the wind, brace the Main-top and the Mizzen-top (only when full-rigged). When this is done at the right moment the wind will help with the turning because there is still some pressure of wind blowing along the windward side of the Fore-top to the windward side of the Main-top square sails. Which makes the whole tower of sails turn swiftly. If this "Let Go Aft" happens too early the ship will stop turning. When it happens too late, the crew have to brace the yards around without the help of the wind. When the forward movement of the ship stops and she starts going astern, the rudder will be put amidships and over to the other side. Watch carefully with bracing the maintop that the yards don't get hooked by the Fore-yards. It's safer to let the fore-yards jump a little when they start backing. Through this the fore-top will be more effective in its backing power.

Brace around Forward

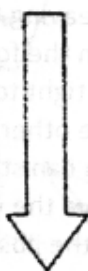
Rond Voor

③

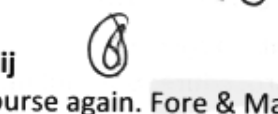
When the aft sails start filling you know for sure that you are through the wind. The Fore-top can be braced around. You will need crew-power here because the sails have to be braced with the wind backing them. Also, the sheets of the headsails can be brought to the other tack. The sheet of the spanker also has to be adjusted. Make sure it is not too tight, otherwise the ship doesn't want to bear away. The rudder can come back to amidships.



WIND RICHING.



OP ZIJN GAT
DRAAIEN.



Full & By

Vol & Bij

⑧

The ship starts to gain speed now and the helmsman can steer a course again. Fore & Main Course can be set again. The yards are trimmed sharp and the sheets adjusted. Decks are cleared and all the lines coiled and put on their pins.

ANCHORING UNDER SAIL

Anchoring

Coming to an anchorage under sail is a perfect manoeuvre to exercise in nice weather. In forgone days the big sailing ships didn't have an engine and they were forced to sail up to the anchorage. The ground-tackle was constructed in a heavy way, so the ship would be safe behind her anchor also in bad weather. A big square-rigger catches a lot of wind with her rigging. When the ship comes into the wind she will lose her speed and when she is stopped the order of "Let Go" Anchor comes from the poop deck. To know how much time is needed before the ship comes to a stop is a matter of experience, so exercising this manoeuvre is a good way to build up that knowledge of your ship. If there is current, take this into calculation. When you drop the anchor there should be little speed over the ground. In these days with GPS this is easy to see. In the past it was more difficult. To make sure that the ship doesn't make too much speed during the manoeuvre, most of the time Royals & Topgallants are taken away, Courses are in their clew & buntlines. The ship is under Topsails, Spanker and a couple of stay sails. By dropping the headsails and pulling the windward sheet of the Spanker we put extra tension on the stern to bring her into the wind. Try to use the windward anchor in this way the anchor chain runs free to windward and does not damage the Bobstay when the ship starts to drift sideways. This is also important if you drop you anchor when there is current, make sure the chain is going to run away from the ship. Sometimes you have to calculate which is stronger the wind or the current. It can be advisable to look at the weather forecast if you expect increasing winds to veer or to back. For a veering wind start with Port and when the wind starts to veer you will drop also the SB anchor, in this way they don't get tangled. For an expected increasing backing wind (Southern Hemisphere) start with the SB anchor.

Weigh Anchor

Just like coming to an anchorage, weighing anchor under sail is a beautiful manoeuvre. Again square rig in this case has big advantages. The certainty that you will sail away from the anchorage on the tack of choice, is a lot bigger on a Square-rigger than on a Fore & Aft rigged vessel. By heaving in the anchor-chain the vessel will move in the direction of the anchor. On a Fore & Aft vessel it can happen that the sails start filling on the wrong tack even when the sails are backing. On a square-rigger the fore-topsails always back properly and with enough wind she will fall away on the proper tack. Assuming that the ship is anchored head into the wind, we can prepare all the necessary sails for setting. We can heave 1 or 2 shackles of the anchor-chain so that the ship is ready to leave. The yards of the Main and Mizzen-top are braced over on the tack we are going to use on our first course out of the anchorage. The yards of the Fore-top are braced aback on the other tack. We now set sail; depending on the circumstances we will set the topsails and maybe also the Topgallants. The courses stay in their clews & bunts. We start heaving the anchor till she is "up and down". The ship will start to make sternway and the backing topsails on the fore-top will push the bow over onto the right tack. We can then set some jibs, keep the sheets really tight to make turning easier. When the Main-top starts to fill, we can brace the fore top around to the other tack and set the spanker and start to set more sail. The rudder starts working and the helmsman can steer a course. In the situation where we have to leave the anchorage on a downwind course, we leave the yards on the Main & Mizzen Top Square, without any sails set. We turn around on the Fore-top and the jibs and after bracing around we set the Fore-Course, in this way we make sure that she will bear away properly to the downwind course.

BOXHAULING "ophok-borck dromen" "open gat dromen" "halte-ophalen by de k"

When the vessel fails to succeed in tacking, the decision can be made to change the tacking manoeuvre into a boxhauling procedure. Boxhauling is also described as the manoeuvre to wear ship without losing any ground. This decision can be necessary if you end up on a lee shore and there is no proper anchor ground. The Boxhauling manoeuvre is a doubtful one. Good Seamanship and the fact, that today, nearly every square-rigger has an engine, you should not end up in the situation that Boxhauling has to save ship and souls. This is a manoeuvre that requires a highly trained crew that is able to brace fast and adequately. But..... it is always good for training purposes in normal conditions and far away from the lee-shore.

—do—

The manoeuvre step by step:

Ready to go about

Klaar om te wenden

We act like the same as if we are trying to tack but that the ship comes to a standstill just before she points into the wind. The Main and Mizzen yards are already braced square.

Brace back Forward

Bras Voor tegen

To make it so that the ship turns back and gains sternway we brace the Fore-top around. This will be a heavy job due to the backing sails on the Fore-top. We brail up the Spanker.

Brace aft Lifting

Achter Levendig houden

The ship will gain sternway and slowly bring her stern into the wind. The Main and Mizzen yards should not work against this movement and we keep them alive. The result in the end will be that these yards are braced sharp for the upcoming new tack.

Brace Square Forward

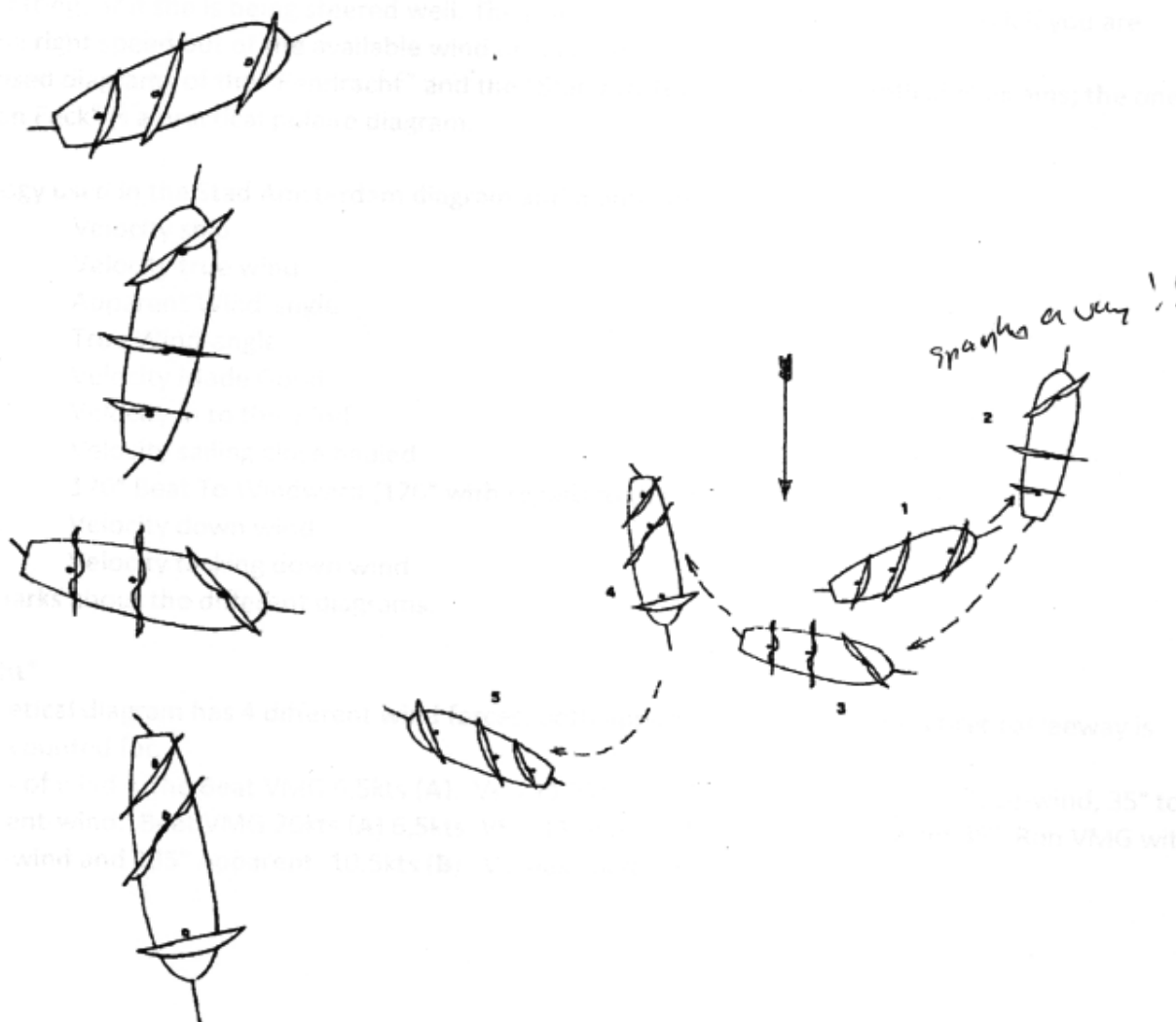
Voor Vierkant brassen

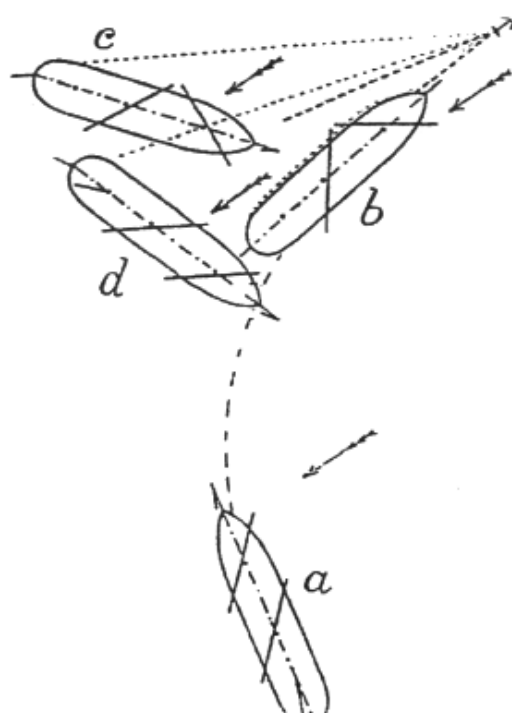
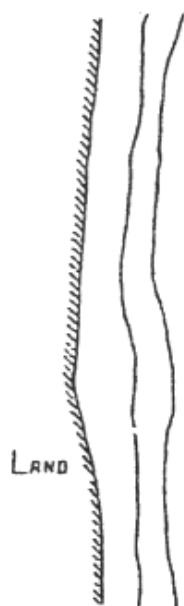
When the stern of the ship is pointing in the direction of the wind and she will lose her sternway, we brace the Fore-top square, by doing so we are more or less at the end of the wearing manoeuvre. The ship will gain forward speed again and start turning.

Brace Round Forward

Rond Voor

As soon as the ship is luffing properly the Fore-top can be braced up to the new tack and the decks can be cleared as in the other manoeuvres.





CLUBHAULING

Clubhauling is another procedure that belongs in the row of emergency manoeuvres. With the help of an anchor a big hawser and a well prepared crew it could you get away from a shallow lee-shore. You lose the anchor in this manoeuvre but if your ship survives it, you will have a good story to tell in the pub. John Harland gives a colourful description of this emergency manoeuvre in his book "Seamanship in the age of Sail".

Chapter 7.

7.1 VPP and POLAIR DIAGRAMS.

VPP.

In the preceding chapters we have seen what the effect of "sail setting" has to the speed on different courses of the vessel. It is obvious that the designer of the ship is interested in these properties in an early stage of the design. Both the rigging design and the shape of the hull have large influences on these specifications. How close will the ship sail to the wind and what will be her maximum speed? On which courses will she reach her maximum speed? All the answers to these questions we would like have before we start building the actual ship. We can calculate the speed of the ship with theoretical and mathematical models. Besides this we can do tests in wind-tunnels and tow-tanks can help us to predict and optimize the final properties of the design. These calculations are called the VPP (Velocity Prediction Program). With the help of the present day techniques we can also look at (existing) traditional vessels and see if we can improve the properties of these sailing ships.

POLAIR DIAGRAMS.

The Polair diagrams will give us the relation between the various variables during the sailing, as there is the direction and velocity of the "true wind", the "relative wind" and the speed of the ship etc. These diagrams can be theoretical, then they are calculated through the VPP, or they made up on an existing sailing-ship in real conditions. The theoretical Polair diagrams will get close to the real ones but still they will be an approximate. The shape of the hull and the rigging-plan of the ship are known on forehand, but you will have also surrounding conditions like the sea state, how much the ship will heel with a certain wind force and sail-setting, or if she is being steered well. The practical diagrams can be used to check if you are getting the right speed out of the available wind on a certain course.

The enclosed diagrams of the "Eendracht" and the "Stad Amsterdam" are theoretical diagrams; the one of the "Gorch Fock" is a practical polaire diagram.

Terminology used in the Stad Amsterdam diagram and many others

Vs	Velocity ship
Vtw	Velocity true wind
AW	Apparent Wind-angle
TW	True Wind-angle
VMG	Velocity Made Good
Beat VMG	Velocity in to the wind
Beat Vs	Velocity sailing close hauled
120°BTW	120° Beat To Windward (120° with regard to the (true) wind direction)
Run VMG	Velocity down wind
Run Vs	Velocity tacking down wind

Some remarks about the different diagrams.

"Eendracht"

This theoretical diagram has 4 different wind forces, both apparent and true. The theoretical leeway is already accounted for.

With 20kts of wind = The Beat VMG 6,5kts (A). Vs = 11,5kts. The ship makes 55° to the True-wind, 35° to the Apparent-wind. Beat VMG 20kts (A) 6,5kts. VS = 11,5kts. BTW 55°, Apparent wind 35°. Run VMG with 152° True-wind and 135° Apparent: 10,5kts (B) Vs max. 14kts with 100° (C).

"Gorch Fock"

This practical diagram is for only one wind force. **Which** wind force is unfortunately not mentioned. BTW = 0,6kts (point **A**) with a true wind angle of 68° (point **B**) and an apparent wind angle of 57° (**C**). With this optimum course the ships speed will be 5,6kts. This is about half the speed of Vs max. (11.25kts).

Run VMG with 163° : 10,25kts. (**D**) The run Vs will be about 10,75kts.

Vs max. is 11,25kts with 147° in regards to the true-wind (**E**) and 120° in regards to the apparent-wind (**F**).

"Stad Amsterdam"

All (theoretical) diagrams are in regards to the true-wind.

The little squares are the different calculated points which are mentioned by VPP Output.

The diagrams are broken because of the different sail-settings. In this it's obvious that we deal with a theoretical diagram.

With 25kts of wind = the Beat VMG 5.15kts

Vs max. = about 123° from the true-wind.

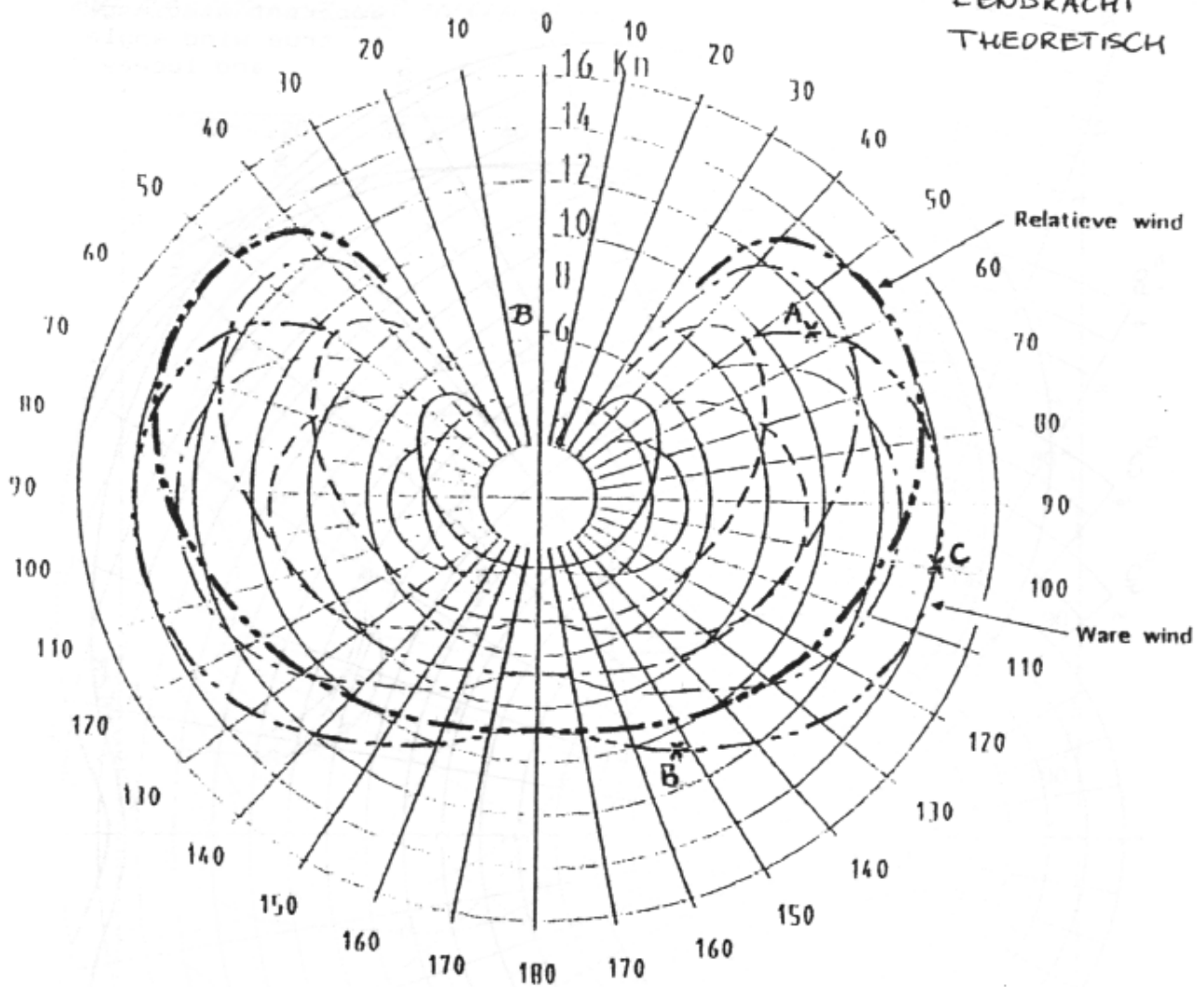
Run VMG with 25kts of wind = 10,8kts.

What can we do with all this data?

In the design stage of the ship we can use the data to predict the sailing-properties of the ship and to improve them. The speed and the angle to the wind when sailing close hauled is of great importance.

When the ship starts sailing it is of course important to know if the calculated theoretical values match the practical performances of the vessel. These values we are going to use to calculate and plan future voyages but also when racing with other square-riggers. You can also use these values for routing purposes. From these diagrams you can learn that it is not advisable to sail exactly downwind in a run. Tacking downwind gives you more speed. Also they provide feedback while sailing, for instance the diagram tells you a certain speed with a certain wind. If you are not making that speed you should look around: what is going wrong, sail-setting, helmsman, sheets, balance?

EENDRACHT THEORETISCH

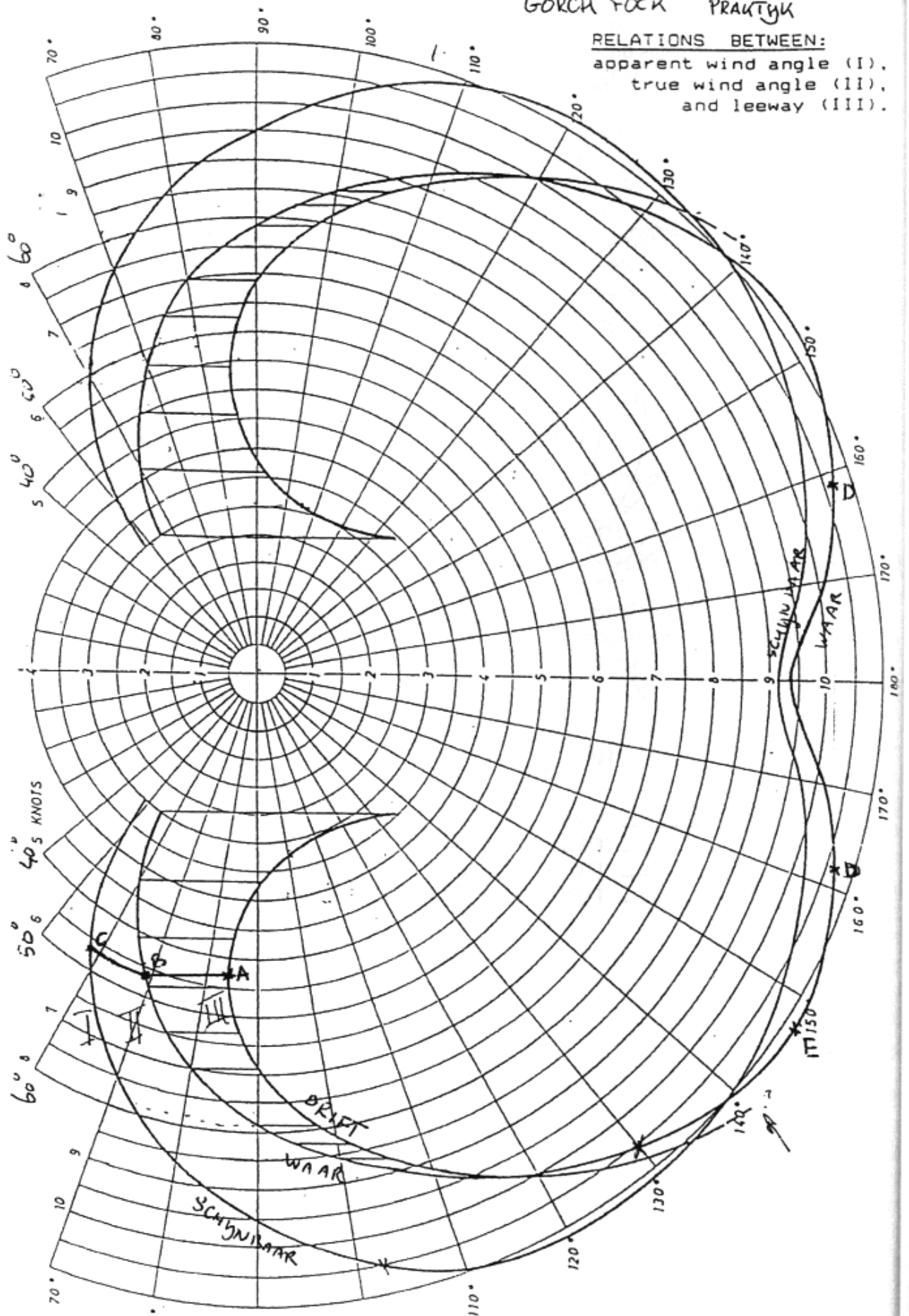


- TWS = 5 Kn (Bft = 2) Drift est. 5 degr.
- - - - - TWS = 10 Kn (Bft = 3) Drift est. 5 degr.
- · — · — TWS = 15 Kn (Bft = 4) Drift est. 7 degr.
- · - · - TWS = 20 Kn (Bft = 5) Drift est. 9 degr.

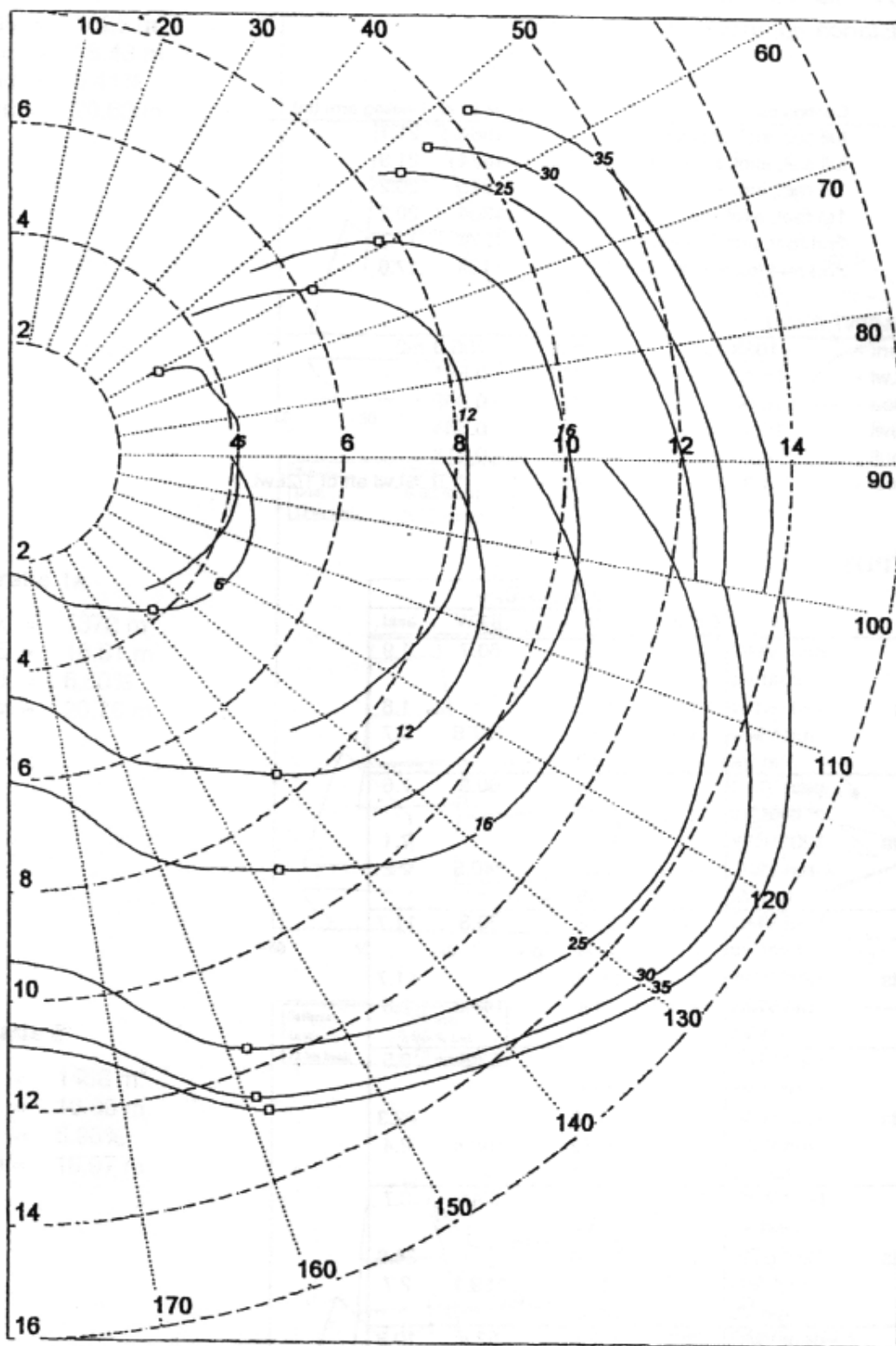
GORCH FOCK PRAKTYK

RELATIONS BETWEEN:

- apparent wind angle (I),
- true wind angle (II),
- and leeway (III).



DOA DISPLACEMENT
WAVE RESISTANCE NOT INCLUDED



Project:	Stad Amsterdam	Ocean Sailing Development Holland BV
File:	H:\EROEN\Clipper\VPP data.xls\Blad 2	Gerard Dijkstra
By:	J. de Vos	v. Baerlestraat 10,107 AW Amsterdam, Holland
Date	9-jul-98	Tel: +31 (0)20 6715830 Fax: +31 (0)20 6753118

VPP INPUT Stad Amsterdam-B

Wave resistance not included

SAILS:

Code	Configuration	Area (m2)	Heeling arm (m)
1	full sail, incl. staysails	1884	21.7
1a	full sail, excl. staysails	1574	21.9
2	1st reef, incl. staysails	1675	20.2
2a	1st reef, excl. staysails	1364	20.2
3	2nd reef, incl. staysails	1274	17.3
3a	2nd reef, excl. staysails	1129	17.6

DISPLACEMENT (DOA):

Displacement -	1038 ton	WSA -	705.9 m2
Lwl -	55.43 m	Cp -	0.581
Boa -	10.50 m	Cb -	0.359
Bwl -	10.41 m	Cwp -	0.664
Thull -	4.20 m	Cm -	0.618
Ttotal -	4.80 m	LCB -	1.0 %Lwl aft of 1/2Lwl

VPP OUTPUT

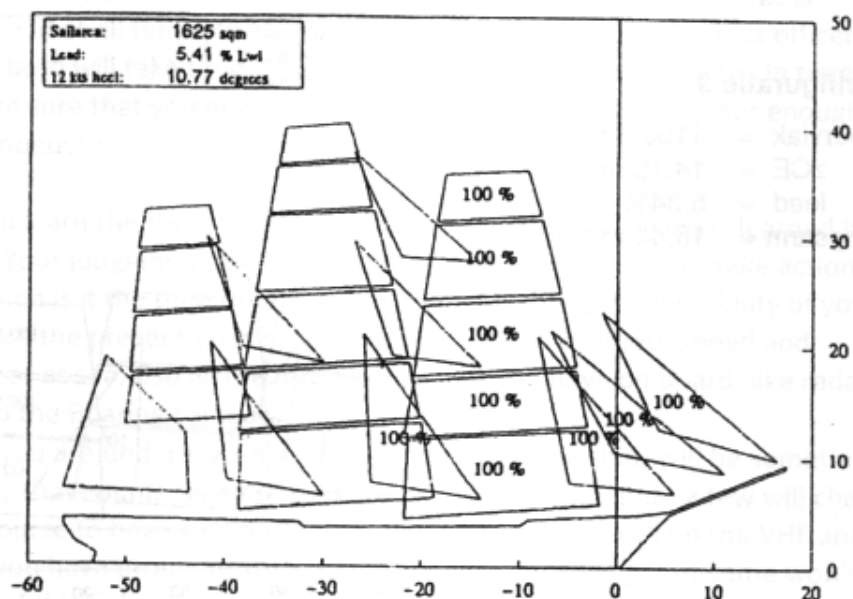
		Stad Amsterdam			
		Code	kts	BTW	heel
Vtw = 6 kts	beat VMG	1a	1.50	60.7	1.9
	beat Vs		3.06		
	120° BTW	1	4.51		1.8
	run VMG	1	2.83	137.6	0.7
	run Vs		3.83		
Vtw = 12 kts	beat VMG	1a	3.03	60.8	7.6
	beat Vs		6.21		
	120° BTW	1	8.94		7.1
	run VMG	1	5.83	140.5	2.2
	run Vs		7.56		
Vtw = 16 kts	beat VMG	1a	3.92	59.3	11.7
	beat Vs		7.68		
	120° BTW	1	11.15		11.7
	run VMG	1	7.54	147.3	2.3
	run Vs		8.96		
Vtw = 25 kts	beat VMG	2a	5.15	53.5	8.5
	beat Vs		8.67		
	120° BTW	1	13.83		22.3
	run VMG	1	10.79	158.4	2.4
	run Vs		11.61		
Vtw = 30 kts	beat VMG	3a	5.61	53.1	8.7
	beat Vs		9.33		
	120° BTW	2	15.64		24.6
	run VMG	2	11.65	159.1	2.7
	run Vs		12.48		
Vtw = 35 kts	beat VMG	3a	6.30	52.4	10.8
	beat Vs		10.30		
	120° BTW	3	15.60		22.1
	run VMG	3	11.88	158.5	2.4
	run Vs		12.70		

-00-

Figuur 6.5a, Zeilvoeringen Stad Amsterdam

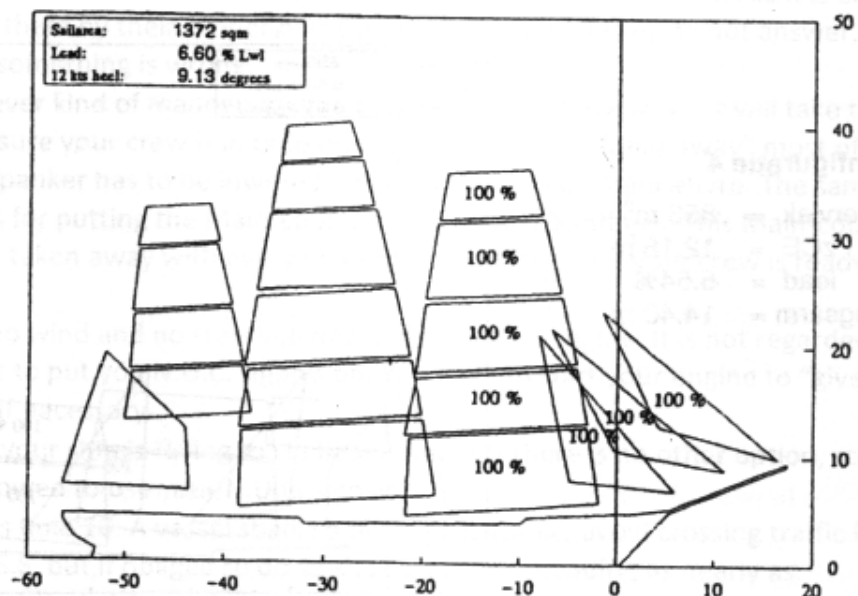
Configuratie 1

oppervlak = 1625 m²
 zCE = 18.43 m
 lead = 5.41%
 hellingsarm = 20.68 m



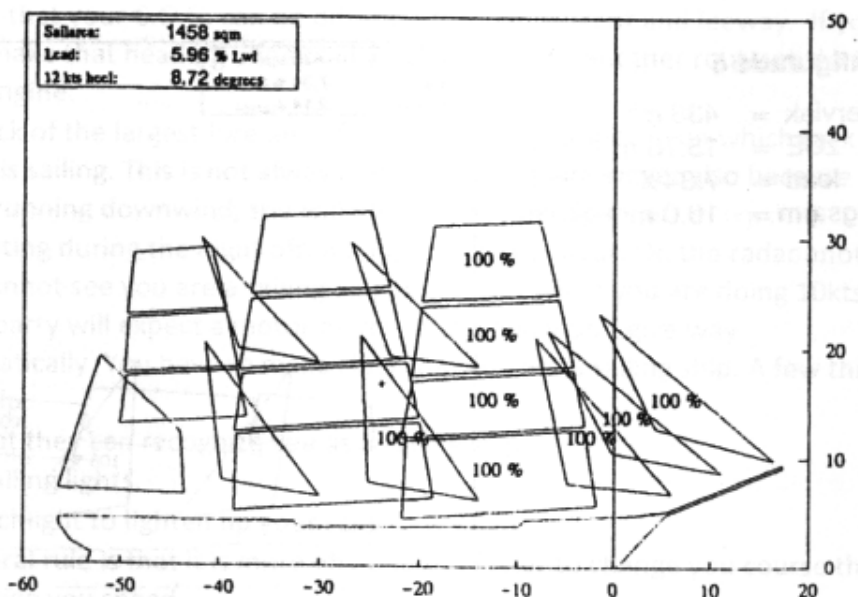
Configuratie 1a

oppervlak = 1372 m²
 zCE = 18.51 m
 lead = 6.60%
 hellingsarm = 20.76 m



Configuratie 2

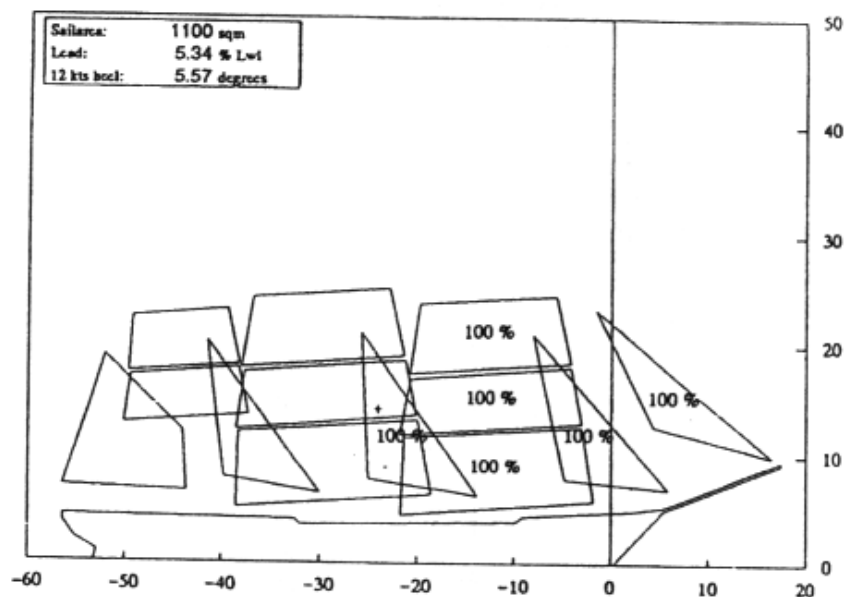
oppervlak = 1458 m²
 zCE = 16.69 m
 lead = 5.96%
 hellingsarm = 18.97 m



Figuur 6.5b, Zeilvoeringen Stad Amsterdam.

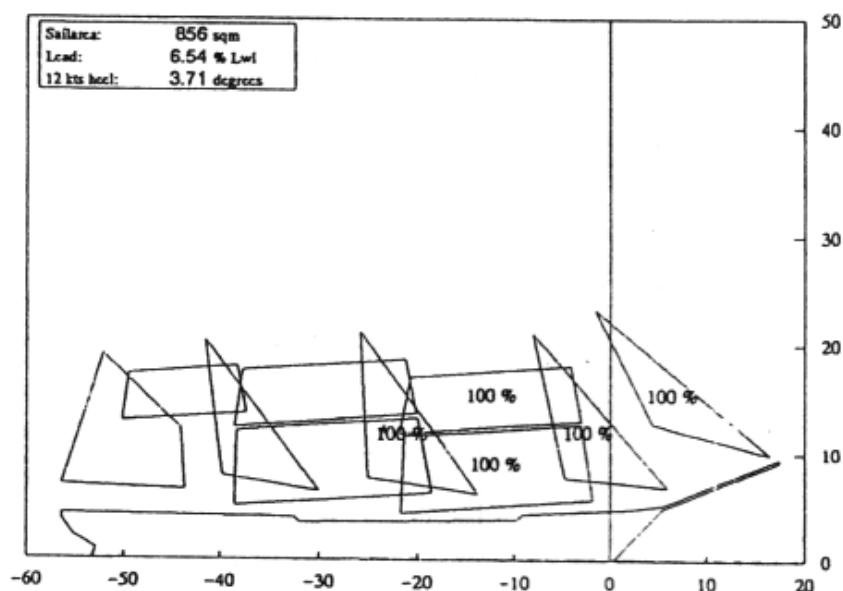
Configuratie 3

oppervlak = 1100 m²
 zCE = 14.19 m
 lead = 5.34%
 hellingsarm = 16.44 m



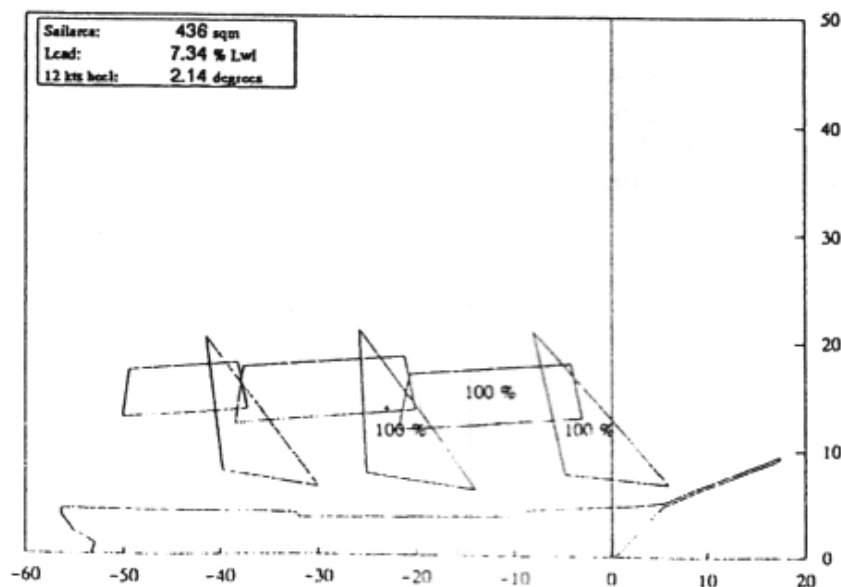
Configuratie 4

oppervlak = 856 m²
 zCE = 12.15 m
 lead = 6.54%
 hellingsarm = 14.40 m



Configuratie 5

oppervlak = 436 m²
 zCE = 13.75 m
 lead = 7.34%
 hellingsarm = 16.0 m



7.2 MANOEUVRES UNDER SAIL WITH OTHER TRAFFIC

It will be clear to everybody that the manoeuvrability of a square rigger under sail is limited. This is something that you should be aware of at all times. In all the measures you want to perform as officer of the watch, you should realize that these will take time. You have to take appropriate decisions in time. Anticipating will be the motto. Make sure that you never end up in a situation that there is not enough time left for making the proper manoeuvre.

Some general remarks:

- You can learn the theoretical rules from the books, but sailing is learned by doing. Your judgement is of great importance. Do you need to take action or not, when is it the time to take action? What is the manoeuvrability of your ship with the present crew? Start from day one to estimate speed and distances at sea. Use all the navigational aids you have on board, like radar, AIS and the Bearing compass.
- When you are under sail on a square-rigger you (the ship) will be something to look at. That counts for ships that are passing you and quite a few will change their course to have a closer look. Some will give you a call on the VHF and ask you if you have problems with their intended sightseeing, but some won't. Be aware of this behaviour and give them a call. In these days with AIS it is ease to call them by their proper name and call-sign and if they do not answer, you know something is wrong.
- Whatever kind of manoeuvre you choose from to "give way", it will take time. Make sure your crew is in time on their positions. To "bear away" most of time your Spanker has to be lowered. This has to be a fast manoeuvre. The same counts for putting the Main-course in her clew & buntlines. This Main-course will be taken away with every manoeuvre so make sure your crew is ready for it.
- With no wind and no steering-way and having an engine: It is not regarded as decent to put you N.U.C. signals on. You have to start your engine to "give way", if necessary.
 - When your ship is "Lying to" in heavy weather there is no other option, so you are allowed to use your N.U.C. signals.
 - Colregs Rule 10: A vessel shall, so far as practicable, avoid crossing traffic lanes of a T.S.S. but if obliged to do so shall cross on a **heading** as nearly as practicable at right angles to the general direction of the traffic flow. This means that your C.O.G. can be different through current and leeway. If you can't make that heading under sail you have to take another route or start your engine.
 - The tack of the largest fore and aft sail is leading, to specify on which tack a vessel is sailing. This is not always clear on the square-rigger also because when running downwind, she will often drowse her Spanker.
 - Navigating during the night often happens on the radar. On the radar another ship cannot see you are a sailing-ship. Especially when you are doing 10kts the other party will expect a motor driven vessel and won't give way automatically. You have to make clear that you are a sailing ship. A few things can help.
- Use your AIS properly so that they can recognize you as a sailing ship
- Use the Red above Green sailing lights.
- Use working lights or a searchlight to lighten up your sails.
 - A general rule is that it is more obvious and faster to change you course then to change you speed.

- Colregs Rule 14: When two **power**-driven vessels are meeting on reciprocal or nearly reciprocal courses, so as to involve risk of collision each shall alter her course to starboard so that each shall pass on the port side of the other. In Rule 18 it is stated that the power-driven vessel should give way to the sailing vessel. But if the other ship is not aware that you are a sailing ship she will expect that you are going also to starboard. When you are sailing clause hauled over SB-tack this will not be possible!
- When you are motor-sailing you have to comply with all the rules of a motor-driven ship. With your sails also set, this could bring you in a difficult position.
- Experience will teach you that a lot of manoeuvres are possible with a square-rigger. Just hugging the wind a little, will take the speed out of the ship and make difficult manoeuvres unnecessary. Take care that with everything you do. Your manoeuvres should be clear and in time.
- Fog requires vigilance and a good understanding of Colregs Rule nr 19.

- 1) Know your radar, know what you can do with it but also what it can't do, like the position of the blind sector.
- 2) Keep plotting the contacts.
- 3) Give the proper sound signals
- 4) Make sure you have a proper lookout on the bow with a vhf handset.
- 5) Make sure you have enough crew on deck to manoeuvre the ship.
- 6) Make sure your engine is on standby.
- 7) Reduce to a safe speed.

- Anticipate your route with expected conditions. For example don't sail close to the Portuguese coast, if you expect fog. You will meet many small fishing boats and nets in those waters.
- Make, if necessary, contact with other vessels through the VHF or by using an Aldis light. Use the call-sign and other details that the AIS is giving you. Keep in mind that the sound of your horn carries only about 1 to 1,5 mile and encountering a ship in that distance during fog could already give a dangerous situation.

Underneath you will find some theoretical situations. The reality will be different and maybe more complex, so make always sure you take decisions on the right moment to keep well clear of the other vessel. In the examples we are sailing down wind, close hauled or running with a free wind. The situation is one between a square-rigger and a power driven ship. The plot or the compass bearing shows that there is a possible danger for collision.

1. Power driven ship is approaching over Starboard bow.

2. Power driven ship is approaching over Port bow.

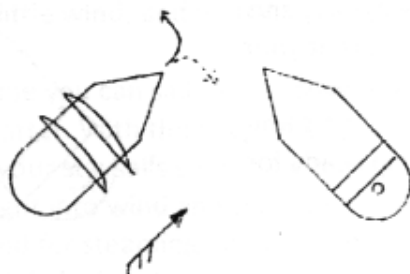
1 Power driven ship is approaching over Starboard bow.

The Power driven ship has to take action (Colreg nr 18), the square-rigger has to keep course and speed. If the Power driven ship does not take action and there is a possible risk of collision and the sailing ship has to take action (Colreg nr 17). Be always prepared for this, because it is well possible that the power driven ship does not realize that you are a sailing ship. It is difficult to decide when the moment is there to take action. Anticipating is the motto.

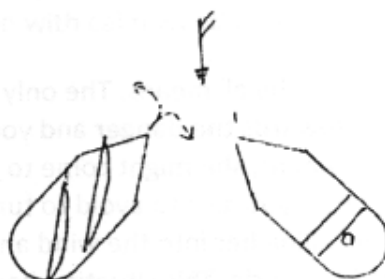
1a Sailing ship is running:

You have 2 possibilities; bracing up to SB or to Port tack. Bringing her up to the port tack is always a good one. You bring her on the same course as the Power driven ship. You will get more speed when you bring her up and the whole manoeuvre can take quite a bit time because of this. Bringing her to SB tack: you will sail in the direction of the Power driven ship, which is not advisable. When the Power driven ship at the same time decides to give way and is turning to Port with the intention to steam behind the sailing ship, the risk of a collision becomes even bigger. Also be aware of your increasing speed.

1b Sailing ship on Port tack:

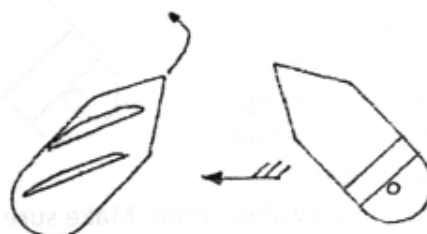


1. Bear away: watch your increasing speed. You are turning towards the other ship. This is not advisable.
2. Stop the ship: this is possible by bracing the main-top aback. This is not a minor manoeuvre, but if prepared well, is a good solution. Make clear what you are doing and it should be obvious that you are reducing speed.
3. Hugging the wind: By hugging the wind you will lose a lot of speed and you can enlarge your CPA. Realise that by losing speed you will lose also the possibility to manoeuvre your ship properly. Make sure you are not running into the wind and caught aback.
4. In emergency: You can always tack but this needs also preparation time. If you tack in an emergency without any preparations you could damage the rig.



1c Sailing ship on SB tack:

1. Bear away: always a good option. The manoeuvre will take time because you will sail alongside the motor driven ship for quite a while.
2. Stop the ship: Bracing maintop aback, hugging the wind is also a possibility but you have to start early with this manoeuvre, to do it effectively.

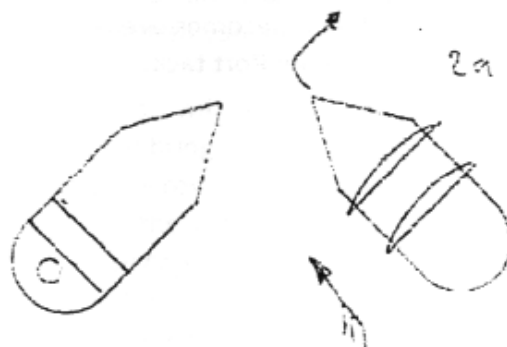


2 Motor driven vessel approaches over Port bow:

According to the Colregs rule nr 18, the motor driven vessel has to give way to the sailing vessel. The sailing ship should keep her course and speed (the stand-on vessel). Does the motor driven vessel not give way to the stand-on vessel you will have to act according to rule 17, and avoid a collision.

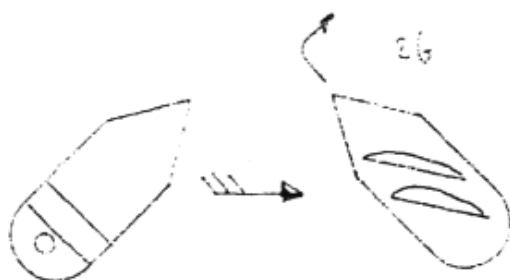
2a Square rigger running down wind:

Theoretically you can go to port or to starboard. To turn to port is dangerous because you will turn towards the danger and if the other vessel is finally giving way she will probably do so by turning to SB. Besides that your speed will increase by bringing the vessel up wind. The logic action is to turn to SB and come to the same course as the other ship and make your ship ready for tacking.



b Square rigger on Port tack:

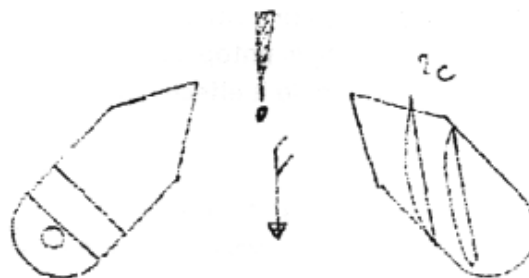
The safe action is to bear away and take the same course as the other vessel. Stopping is an option if you start this manoeuvre in time.



2c Square rigger on SB tack:

This is "bad news". Try to avoid this situation by all means. The only thing you can do is bear-away but this is dangerous because you turn your ship towards the danger and you are increasing speed. If the other vessel decides to give way at the same moment, she might come to SB and make the collision situation even more imminent. Colregs rule nr 17 tells you also to avoid to turn to port if you are the stand-on vessel. The only possibility is stopping or sailing her into the wind and an involuntary tack is your only emergency option, with all the dangers for you rig. This situation has to be avoided, that's obvious. You can do so by reacting and preparing in ample time, that means before there is a danger for a collision, to bear away and steer aft of the vessel.

If it becomes impossible to prevent a collision, make sure the safety of your crew is your main concern and try to keep the damage to your ship as small as possible. Hitting the other ship side to side is an option to keep the damage under control. Another option with a sailing ship is to use the bowsprit as a crush-zone. Prevent getting hit by the other ship in the side because this is the weakest point of the ship. This will be a very difficult decision that you have to take in very short time. Make sure that you will never find yourself in such a situation.



7.3 MOTOR-SAILING

In some circumstances it can be desirable to use the engine and the sails at the same time.

- There is little wind and you have to be at a certain time or date at your destination. Sailing with square sails in a free wind, you will already make a good speed with a gentle breeze. If you start the engine in this situation you will bring your apparent wind rapidly forward and before you know your squares are backing. With fore & aft sails you are able to fill them longer, so they are more effective for motor-sailing. With using an engine it will be giving you more speed in little wind, and with your stay-sails set your ship will roll less and sails will flap less.
- With a running engine you can sail closer to the wind. Tacking with a square-rigger can be a time consuming matter. With the support of your engine your leeway is getting less. Motor-sailing with your staysails set can be paying its way. Often you can hold 45° or even less. Steaming straight into wind and sea is not advisable, it will put huge forces on your rig which is not designed for steaming into a seaway. Try to make the resistance offered to wind as low as possible by bracing sharp. Leave a little slack in the braces so that the tops can move a little. If all the braces are really tight you could crack a yard. It's obvious that the sails have to be stowed nice & tight.
- Safety. With little wind you are more and better manoeuvrable with the help of your engine but also with a lot of wind it can be an advantage to have the support of your engine. Another reason for starting your engine could be the entering of a busy shipping area so that you have more and better options in navigating with busy traffic. Make sure you are carrying the proper signals to show the ships around you that you are a motor driven vessel. (also on the AIS) Take care that your sails are not covering the navigation lights
- Local regulations can force you to sail as a motor driven ship. This could be the case in Ports, Rivers and Canals but also with calm weather at Sea, they can force you to use your engine to give way.

CHAPTER 8

8.1 SAFETY

General

As discussed in preceding chapters, Safety is a subject that will return in many aspects of this course. We could have a special course about safety (SAFAW covers some issues) but here we will limit it with an oversight how to handle the safety on board your ship.

Prevention is better than cure.

With all the things you will do on board of your ship, safety has to be leading. Not only issues concerning the crew but also the ship itself, the planning of a voyage or manoeuvring. Safety is the start of everything.

- Keep an eye on your equipment. Don't leave clothing, boots etc. in escape routes.
- Make sure that doors are on their safety hooks when opened.
- Know your safety and emergency equipment on board.
- Make sure sea-fastening is done properly and will stay that way also during nice weather. Conditions can change quickly.

The Classification Society is making sure that the Ship, the Rig and the Equipment comply with a minimum standard of safety. The Captain himself stays at all times responsible for the safety standard and procedures on board. You cannot hide yourself behind the survey or the surveyor of the Class Society. So it can be very useful to send a crewmember with the yearly check of the life rafts at the service station. In this way you have control over a proper service and the crewmember can learn about all the ins and outs of a life raft. Besides the regulated content of a life raft, there is the possibility to add extra's if you sail in special areas. The Captain is at all times responsible for the safety on board. If the ship is small, he will do quite a few aspects of this job himself; when the ship has a larger permanent crew he will delegate more and more to the first Mate. For larger ships this is the officer responsible for all safety issues. He makes sure that the safety equipment is complete and in good order and ready to use. Besides that he is responsible for the training of his crew, so that they can act swiftly and have knowledge when an emergency situation arises.

Safety is a matter of the right mentality. On every moment of the day the whole crew (including trainees & passengers) has to realize that they should not bring the safety of ship and crew in any danger what so ever by their deeds. Finally: Know "Murphy's Law", if one thing goes wrong, it's just a matter of time before the next thing goes wrong.

Keep in mind during a Calamity.

If a calamity takes place on board, please take note of the following points (see also SAFAW):

- Try to get a "helicopter view" of the situation as soon as possible.
- Take the lead, "doing things" is often an excuse for not taking decisions. Make yourself visible for the crew.
- Every plan is better than "no plan".
- Set your priorities. Saving as many lives as possible, is the aim.
- Keep Calm! There is Hope! Losing hope is disastrous for the spirits of the crew.
- Don't deny the situation.
- Give clear orders. Watch out for orders that contradict each other! Be honest, but you don't have to tell all the details. Watch your language! Don't talk about a disaster or crises but about a serious situation, accident or an emergency etc. Information should always be confirmed. Keep your voice low, don't yell and watch your posture.
- Go by the exercised procedures, you didn't create them for nothing.
- Fear makes stupid. Give clear instruction and act according to your exercises!
- Chose the right people for the right jobs.

- Make sure people don't get double jobs. The more jobs a person has to fulfil, the worse his performance will be.
- Realize that Guests, but also crewmembers will not always cooperate properly.
- People have the habit to listen to persons in uniform.
- Prevention is better than cure!

Education and Training

Make sure your crew is trained and educated for their safety jobs on board. You have legislation on your side for safety courses of your crewmembers. Which of these **STCW** (Standards of Training, Certification and Watchkeeping for seafarers) are required for your crew is dependent on the type of vessel and your position on board.

Some of the STCW training courses:

- STCW 02 Basic Safety (formerly Pre-Sea).
- STCW 03 Proficiency in survival craft.
- STCW 04-3 Advanced Fire Fighting
- STCW 08 Crowd management training
- STCW 09 Passenger Safety Training.
- STCW 10 Crises Management Training.

Testing & Exercises.

It is of great importance that you frequently practice the things you learned. Through these exercises a number of these (emergency) situations are becoming more familiar to the crew. Also the familiarisation with the safety and emergency equipment is very useful if a real emergency or safety issue arises. Exercising could also just be the regularly use of equipment like the MOB boat or a Zodiac. In frequent use of equipment, faults or defects will show up early and can be taken care of. If a real emergency situation pops up the crew knows how to handle the equipment and is not nervous about it. (Gives less panic). In these emergency situations it is of great importance that the ships officers stay calm; give your orders in a restrained way to all trainees/guests and crewmembers. Keep your exercises in Abandon Ship and MOB regularly. Doing is learning. Testing is not the same as exercising. An exercise has the aim of learning. You start an exercise with a briefing (what are we going to do). During the exercise you can stop the proceeding and start again or adjust the exercise. Give a debriefing after the exercise and make a written report which circulates and have all the participants signing that they have read the report. In this way you get input from everybody involved and the debriefing helps to understand why and how to do it better next time and if any procedures have to be changed. Testing is checking if your "station bill" or parts of that bill are working properly. This can be done by giving an unannounced fire alarm and to watch if the stations are manned as planned. Or you throw a carton box or lifebuoy over the side and give an MOB alarm. After the test you will know if more exercises are needed. This "Testing and exercising" most of the time has to happen in the free-hours or when all the watches are awake. The crew is not always enthusiastic about the timing so try to find the right time. Don't give long talks in cold or rainy weather. If at all possible, explain and exercise in small groups during quiet watch hours.

It is very important that your crew is motivated to Test & Exercise all these emergency procedures.

Procedures (Flowcharts) and Station Bills

In case of an emergency the crew has to know what to do and where to go. This is why we have procedures and station bills on board. Procedures make that the actions that we take work out smoothly and that all involved know their job and position. In an emergency situation this will prevent chaos and stress. We do have for instance the IAMSAR a procedure to run in the case of a Search & Rescue operation. It is of great importance to follow these International guidelines and procedures to make an operation like this effective. Other procedures on board are Medevac or Radio Medical Advice and a communication

emergency plan with the office but also flowcharts for:

- Helicopter operations
- Grounding
- Danger of Flooding
- Serious Injury
- Oil spill prevention
- GMDSS Received Distress Alert
- Main engine failure
- Fire flowchart
- Etc. etc.

These Flowcharts – Checklists and other important emergency knowledge are gathered in the Bridge Emergency Folder, sometimes called the DSSM folder (Decision Support System Master). This folder is for the decision-taker on the bridge so he can check point by point, so nothing is forgotten in the heat of the moment.

Station Bills are posted on several places in the ship and appoint **named** crewmembers to a certain position for

- Fire
- Man Overboard
- Abandon Ship

Always make sure that the Station Bill is up to date for a certain voyage, that the mentioned crewmembers are physically on board and that they have received the proper training to fulfil the duties mentioned on the Station Bill. It is also possible make a station bill on functions instead of names. Still make sure the fire-boots fit the person that should wear them! It is also important that everybody speaks the same language. Keep in mind that for a certain situation a third or even half of the crew could be asleep, so also look to the sea-watches if you make a station bill.

8.2 HEAVY WEATHER MANOEUVRES.

1 General

2 Scudding

3 Lying to

4 Riding the Sea

1 General

In heavy weather you have to create your own good luck. Which precautions have to be taken is difficult to prescribe in theory. The practice is always different and will ask for creative solutions and good seamanship.

Make sure you go to sea well prepared:

- The crew should be in a good health and properly dressed. Everyone coming on deck should wear a harness and secure themselves.
- A proper preparation and explanation in what your plans are will help the crew in knowing what to expect and stop worrying unnecessarily.
- Weather forecasts are essential. In these days it is possible to get a good forecast for every place in the world. Gribfiles, weatherfax charts, spoken forecast, Navtex, Satcom C and through the Internet.
- Your own observation is also important, compare with the forecast and look where the differences are. Check Barometer, Clouds, Veering or Backing of the wind etc.

- Try to get your information from as many sources as possible before you jump to conclusions.
- Know your Oceanography and Meteorology; routing can be essential in longer crossings. (Gulfstream, Tropical cyclones, their seasons and routes, Convergence zones, Pampero's etc.).

On Deck:

- Make sure your ship is watertight. If that is the case you will stay afloat. Keep an eye on concreting the sterling pipes. Shutters for windows and portholes, watertight doors and especially the ventilation openings. (Ventilation checklist and responsibility list)
- Check you stability, (Ballast tanks full, no slack tanks, possible weight out of the rigging on to deck)
- Sea fastening on deck and down below.
- Safety nets and safety lines on deck.
- Locking line on the belaying pins to keep all the lines and their coils in position. (Loose lines will certainly stream over the side through the freeing ports and get jammed.
- Make sure you freeing ports are in good working condition.
- If necessary stream oil to calm the sea, check if you still have this oil on board.

In the Rigging:

- By taking down sails you will bring down your square meters, but also your sailing point.
- Keep your running & standing rigging in top-condition. Maintenance is vital if "the shit hits the fan".
- Make sure you have enough spare equipment on board. (Think of extra lines, blocks, shackles, etc.)
- Storm sails in good condition and within reach. Practice with them in normal weather.
- Make windage as small as possible by bracing and proper stowing of the sails, extra gaskets.
- Give extra attention to the furling of the jibs so they cannot scoop up water when the jibboom submerges.
- Unbend sails like the Flying jib and other kites and bring them under decks.
- Rig storm sheets on the staysails you are still flying. (If the normal sheet breaks, it still has the storm sheet, otherwise you sail would certainly blowout her boltropes)
- Make sure all lines are pulled tight and belayed properly (boom-stops, vang, etc.).
- If you have wooden spars tied down on deck, keep in mind that they start floating when submerged. So you have to tie them down very well.

Squalls:

If need to pay extra attention if you start sailing in squally weather.

Squalls can develop very quickly at sea. Use your radar (especially at night) to detect squalls so you have time to prepare and react properly.

Gust-Front: ----down-flow of cold air.
 ----heavy air, so with the same wind speed more wind force.
 ----in the Northern Hemisphere wind will veer.
 ----consider a down flow component in the wind.

When a square-rigger is hit by a squall the general rule will be: Bear away!

You need of course the sea-room to do that and the sail area that makes bearing away possible.

Bearing away has the following advantages:

- The apparent wind will decrease rapidly.
- Your sail area becomes smaller (sails are taking the wind from each other).
- No backing or flapping sails (less damage).
- The ~~list~~ ^{heel} of the ship will decrease. (smaller chance of a knockdown)
- You keep speed therefore steering way.

Important detail: **You should be able to bear away!** This is only possible if the balance is right. If you wait too long with taking away sails she will start heeling up to a point that bearing away is not possible anymore. Then you will have a major problem! Prevent this by taking down sails in time and don't wait too

long with Bearing Away. In the past Clippers were hugging the wind in squalls. Their high rigging made bearing away often a problem especially when they were sailing close-hauled. In the first 30 degrees of bearing away, the wind force on the high rigging would be tremendous before the ship came in the position that the sails were taking the wind from each other. Hugging the wind was the only solution but a dangerous one.

When you decide to shorten sail on a ship-rigged vessel, start with the main royal and topgallant. On a bark the gaff-topsail and the topgallant-mizzen-staysail and the main royal have priority. The lowering of the yards will have positive effects on the windage as well. Make sure your spanker can be sheeted out immediately. Be in time with shortening sail so you can put gaskets on the sails before the squall hits you. Backing sails won't come down easily! After you have taken down your topgallants you have to choose for the next option: "Upper-topsails" or "Courses". In general the choice will be the Courses, so you can brace swiftly without handling sheets & tacks.

2 SCUDDING:

Scudding (Lenzen) or running down wind is as we have seen in the squally weather chapter a good option in heavy weather.

- 2 The apparent wind is decreasing. Watch out for deception, it blows stronger then you think!
- 3 The wavelength becomes longer, it will make living on board much more comfortable. Also less stress on the rigging. Watch the wave-height and the possibility of being pooped.
- 4 You need enough sea-room on lee to make this scudding successful for the length of the storm. Besides that there is a change that the seas become too high and that a Lying-To manoeuvre has to be made. If you have a high wave amidships the stability is becoming considerable less. Don't wait too long before you decide to go execute Lying-To. On a certain moment it will be very difficult to make that manoeuvre and the chance of "Broaching" becomes imminent. Just like surfing: if the ship runs downhill from a wave the poop will be pushed more than the bow and will move sideways down the wave, Broaching will be the result. Bringing her in the Lying To position has to be planned carefully and the use of the engine should be considered. Try to stay in this vulnerable position as short as possible.

Sails to set:

Fore-lower-topsail, Fore course, storm-jib.

Because you are sailing downwind you want sails on the fore-ship that will pull the ship through the seas. By easing the sheets of the Fore-Course and the Fore-Lower-Topsail a little the sails will lift more and this prevents the bow getting too much down in the seas. If it starts blowing harder you have to take the Fore-Course away or put a reef in. You can also decide to hoist a main-staysail so the rolling of the ship becomes less. With a high sea running the effect will be limited.

3 LYING TO:

Know the difference between Heaving to (Bij draaien) and Lying to (Bij liggen)!

Bring the ship close to the wind, about 4 points with as little sail as possible. Just as with Heaving To it is important to bring the ship in balance. Lower topsails (sometimes goose winged), a storm jib and a mizzen staysail will do the job most of the time. In the "Lying To" position, basically all kinds of weather can be taken.

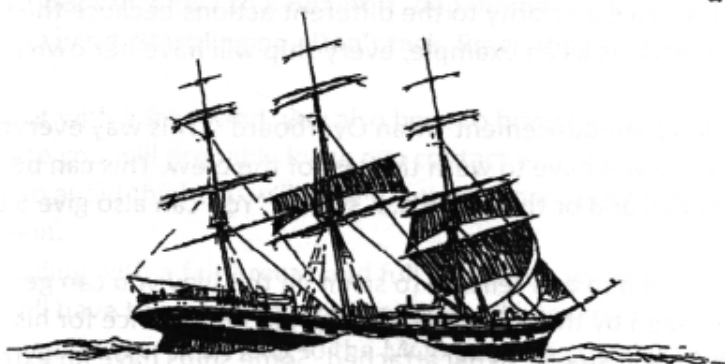
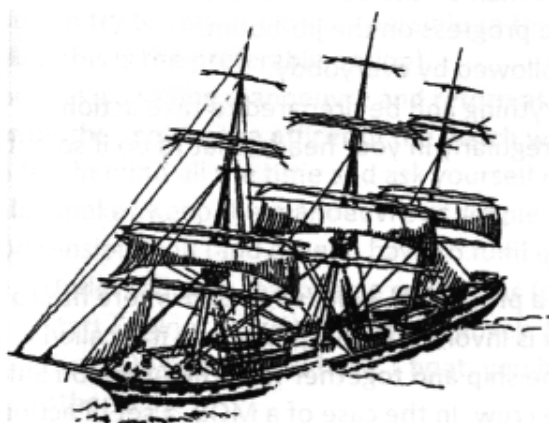
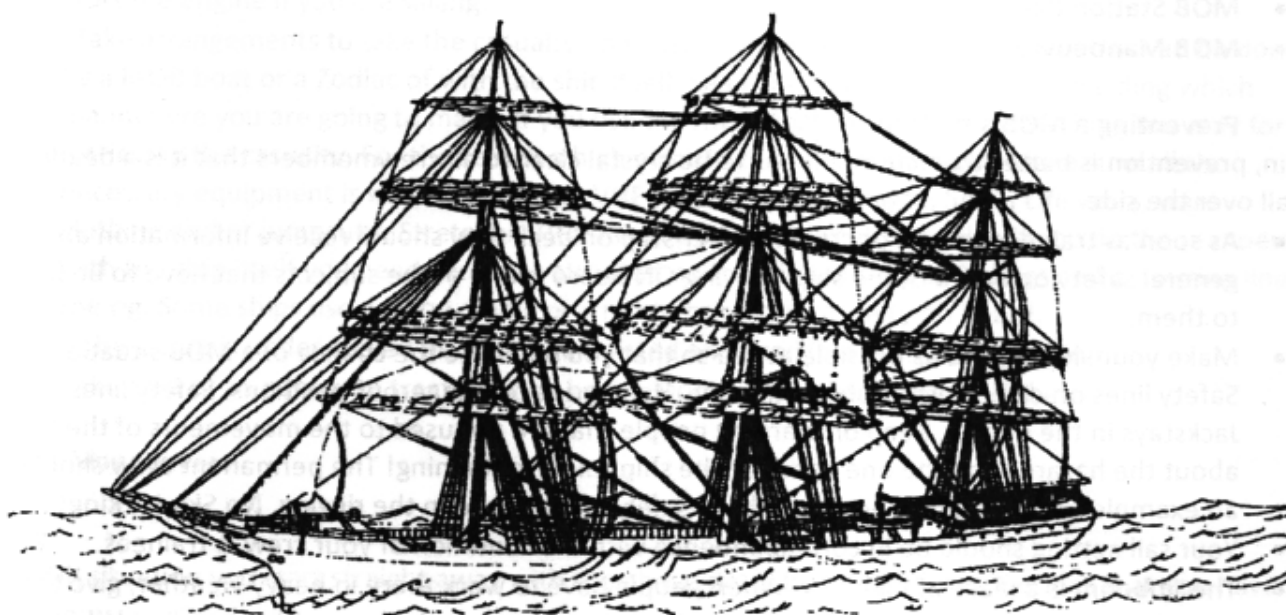
Sails to set:

Storm-jib, main-lower-topsail, trysail.

Try to set the minimum of sail, but the ship needs some forward power to stay close hauled. This balance has to be found in practice, every ship is different. You need strong storm sails and the lower-topsails which are made of the heaviest canvass. There is a possibility of setting the Lower-topsail goose winged. You set the leeward side of the sail and the windward side is furled with the gaskets. An extra-long and strong gasket is taken around the sail + yard by the truss. All sheets should be as tight as possible.

4 LAYING A 'HULL or RIDING THE SEA:

Riding the sea (Voor Top & Takel liggen) is your last resort. All the other manoeuvres failed. The ship will find her own position in the wind and the sea. This won't be comfortable. You can try to bring some canvass on the windward side of the mizzen shrouds so she will bring her head a bit more in the wind. Make sure everything is closed properly and stays closed. Many ships survived in this way. If your ship is dismasted, try to get rid of the rigging which is dragging alongside the ship. There is a chance that this debris will damage the hull. It won't be easy to work on deck in these conditions but you do not have another choice. With the remains you will have to build a jury rig. Time to use all your creativity!



8.3 MAN OVER BOARD:

Having a man over board is a very serious situation. On a motor driven ship it is already difficult to get the victim back on board, on a sailing ship the conditions are even worse!

Your main goal will be, as in other cases, **to prevent that you will end up in a MOB situation!** In the case that it happens, you as officer of the watch will have to take decisions immediately and take actions at the same time. These actions and decisions can only work out properly if exercised regularly. The MOB procedure has to be well known on board and tested on a monthly basis. For passenger ships there are even more strict rules about this subject.

- **Prevent a MOB situation**
- **MOB Station Bill**
- **MOB Manoeuvre**

1 Preventing a MOB situation

Again, prevention is better than curing! It has to be crystal clear to all crewmembers that it is a deadly sin to fall over the side.

- As soon as trainees, guests or crewmember step on deck they should receive information about the general safety on board of the ship. Staying ON board is one of the subjects that have to be brought to them.
- Make your ship as safe as possible at sea so that you minimize the chance of a MOB situation. Safety lines on deck, netting above the rail. Hand grips on dangerous positions. Safety lines and Jackstays in the rigging. Keep on warning people that are not used to the movements of the ship, about the hazards and the one hand for the ship rule! No Running! The permanent crew should be an example to the trainees how to behave safely on deck and in the rigging. **No Sky-Larking!**
- Your sail-setting should be in correspondence with the condition of your crew & trainees.
- The Jibboom is a place of high risk. When people have to work there in heavy weather, give the ship a save course to take down sails and stow them. Put a man on the bow with a handheld vhf to communicate with the bridge about the situation and progress on the jib-boom.
- Make sure that the safety rules on board are being followed by everybody.
- As officer of the watch keep a sharp look out for everything and be prepared to take action immediately if somebody drops overboard. Exercise regularly in your head, what to do if somebody drops overboard now at this very moment.

2 MOB Station Bill

As with many actions on board the MOB is also described in a procedure, who, what and where has to be done in the case of a MOB. Because a great part of the crew is involved in this procedure it is called a "Bill". This Bill is, like other procedures, part of the SMS of the ship and together with the Abandon Ship and the Fire procedure regularly exercised and tested by the crew. In the case of a MOB, a set of actions have to be taken simultaneously. It is difficult to give a priority to the different actions because they are of equal importance. Below you will find a set of actions as an example, every ship will have her own plan of action:

- **ALARM!** Start with a very clearly and loud announcement "Man Overboard". This way everybody on deck can come in action. Besides that you will have to warn the rest of the crew. This can be done with a continuous ringing of the alarm bell and or through a p.a. system. You can also give 5 short blows on the ships horn.
- Take care of the casualty in the water! Call him and tell him to swim. In this way you can get him out of a shock and he knows that he is seen by the ship, which is of great importance for his motivation. Throw a Life-buoy with light and smoke signal attached. Some ships have an extra buoy with a flag and radar reflector on a stick (Dan buoy). Some ships have a small life raft that has to be thrown overboard in which the victim can climb into. These rafts should have a large sea anchor so that they don't blow away.

- The Lookout; the first person that enters the poopdeck should grab a handheld vhf and a pair of binoculars and climb the Mizzen-top. He has to keep his eyes on the victim and point with his arm in that direction. He can communicate with the man in charge of the manoeuvring.
- Pinpoint the MOB position. In these days that can be done on the radar, the gps, the electronic chart. Through testing and exercising you will find the best way to do this. Take drift and current in account.
- Call for help to the outside world. Depending on your position you can report to Coastguard or other ships in the vicinity on VHF ch16. Don't wait too long with this call. The sooner a SAR operation can start the bigger the chances of surviving for the casualty.
- Start your manoeuvre, whatever that may be.
- Start the engine if you are sailing.
- Make arrangements to take the casualty on board. Depending on circumstances this can be done by a MOB boat or a Zodiac or with the ship itself. Sea conditions are leading in deciding which manoeuvre you are going to make. If you use the MOB boat this is not for searching but only for retrieving the casualty. For the search a high place in the mast is the best. Make sure all the necessary equipment is in the MOB boat, VHF handheld, Searchlight, SART, Life vests, warm clothing and or jumpsuits, Stretcher, TPA, Jason cradle or something alike. If you do the manoeuvre with the ship itself you need a jumper attached on long line, a sling or 2 slings and a hoisting line in the rig. Some ships use a Jason cradle or a net to bring the casualty on board.
- If the victim is under cooled he has to be hoisted on board in a horizontal position.
- Take care of an adequate treatment on board, Doctor or Radio Medical Advise!

3 MOB Manoeuvre:

Sailing:

In a MOB situation you start straight away with the above described procedures. Besides that you have two options:

- a) You can try to stay as close as possible to the casualty so that you keep in eye contact with him. (If possible this is the preferable option).
- b) You make a sailing manoeuvre and return as close as possible to the casualty. This choice has to be made on the spot by the officer of the watch without any doubts. Prepare yourself for such a decision. Keep this in mind all the time and ask yourself once in a while: what if it happened now! Which decision should I make? Keep the manoeuvre as simple as possible. Even if there is no panic under the crew, there will be tension. You (and others) have to fulfil quite a few actions in a short time, without thinking.

- Under sail with reasonable conditions (up to 6 Beaufort): stop the ship by running into the wind. Start Engine. Brace the maintop aback. Maybe you will tack maybe not, it doesn't matter. Launch the MOB boat (if you have 1 boat, you have to make lee on that side. Take away the squares and other sails.
- Under sail with 7 to 8 Beaufort, depending on the ship: come up to close hauled and start hugging the wind. Start Engine. Don't tack. Brace the Main aback.

Running or with a free wind, you also have to bring her up to the wind. This can take some more time and in this case you will probably loose eye contact with your casualty. You are "heaved to" but somewhere else, try to avoid this! You will have to make a manoeuvre to sail back to the casualty and stop the ship there again.

- Sailing with a fair breeze and full speed you will lose contact with your MOB in very short time. You will have to make a manoeuvre and sail back to him. With lots of wind this will be a wearing ship manoeuvre. Returning to the MOB position you start a search pattern.

It's obvious whatever the manoeuvre will be. It will be quite an operation. The fore and aft rigged ship has here the advantage.

Under Engine power;

This is already discussed in the 1st year.

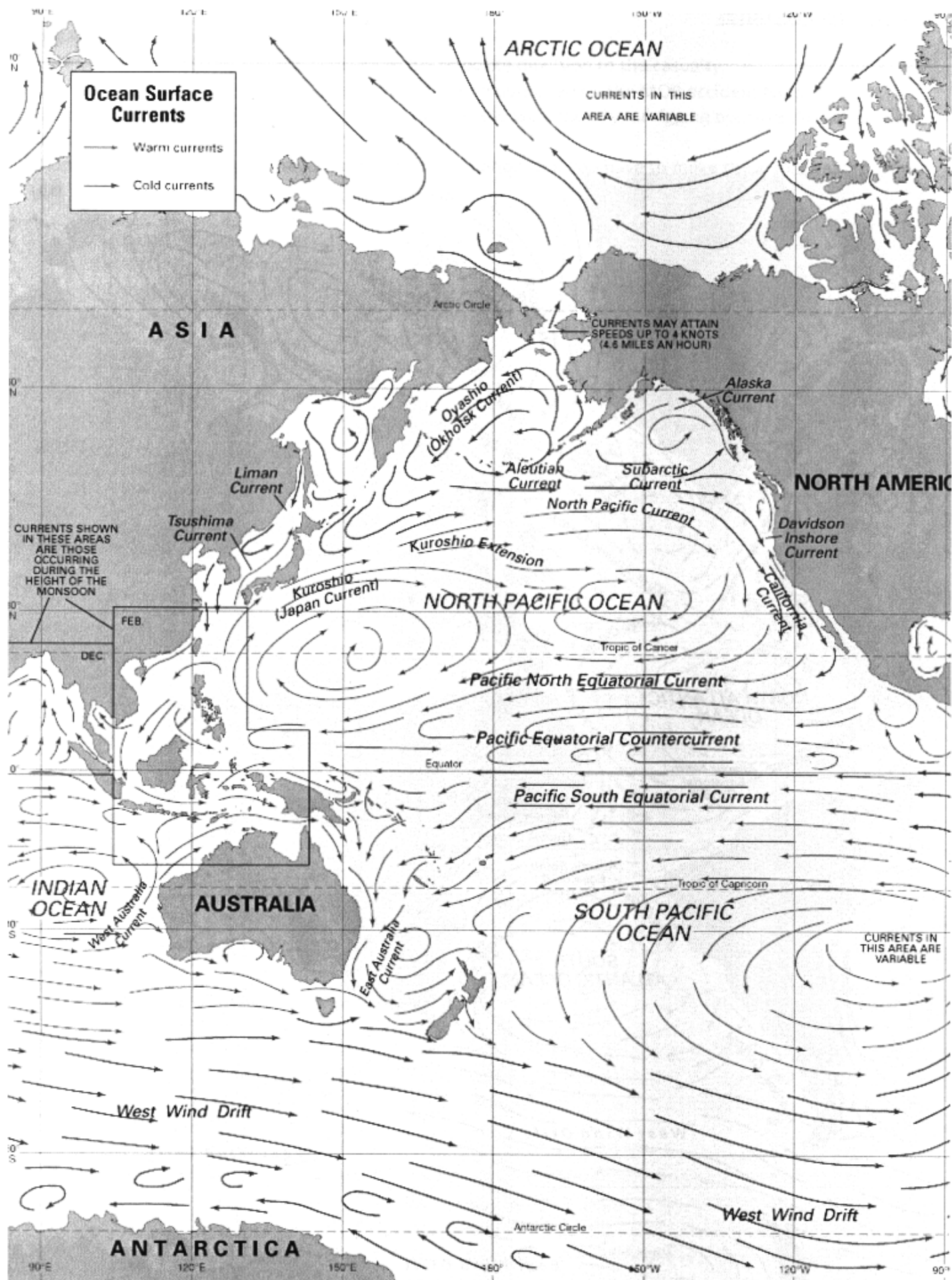
- Williamson Turn: you will come from the opposite direction to the casualty.
- Elliptic Turn: you will arrive from the same direction as when the MOB accident happened.

Whichever manoeuvre you are making, keep in mind the windage of your rigging because this can make a lot of difference in where you will end up.

I hope sincerely that you will never come into the situation that you have to make these manoeuvres for real.

ANNEX: Sailing routes





SETUP:

- and low
✓
- High pressure areas on earth
 - Prevailing winds
 - Ocean currents
 - Hurricane areas
 - Dangerous areas
 - Routeing per area
- use of pilot charts and ocean passages

PRINCIPLES:

- Doldrums
- Horse latitudes
- Tradewinds
- Monsoon
- Continental shelf
- Intertropical convergency zone

EZS 2013 C. Wassenaar

Ocean currents

- Caused by prevailing wind
- Course changed by Coriolis force

www.purplegamer.com/game/3661f2ddef

EZS 2013 C. Wassenaar

- 107 807107 -

South-: Cape of good hope

- Roaring forties, screaming fifties
- Agulhas current: *"freakwaves"*, southgoing stream 6 kt → Prevailing westerly wind



25°N; 30°W (see text page 166) pick up NE tradewind.

Not too far east: Doldrums area larger!

Not too far west: S- hemisphere SE tradewind

South-Atlantic: Cape Horn

Going west: South first! South side L

But.... NOT too far!

Going east: prevailing winds, Stay North of L!

E2S 2013 C. Wassenaar

1914 "Edward Sewall"

Panama channel

O-W: first go south before heading W
(Galapagos) → Peru current

W-E: lee shore Caribbean sea

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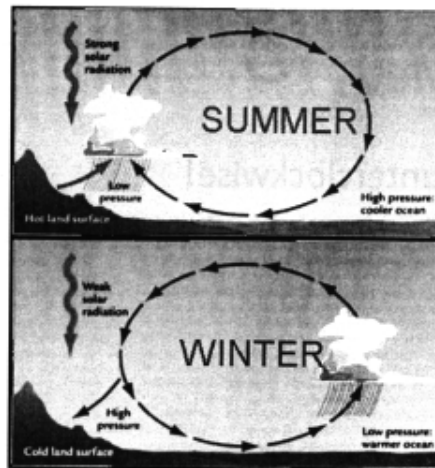
Indian ocean

Monsoon!

N winter: NE

N summer: SW

Difference in
temperature



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Indian Ocean

- In the winter head west, in the summer go east
- NE monsoon 4-5 bf; SW monsoon 5-7 bf
- Entrance Red sea 8 bf!
- Suez channel: not sailable

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Southern Pacific

East to west: SE tradewind

West to east: first go south (westerlies)

Atolls: reader page 177

→ Sun from behind and enter with daylight.

Polaroid shades!

→ Be aware of strong currents! Differences in waterlevel inside-outside atol

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Med

Current goes counterclockwise!

W-E stay south (in winter leeshore)

E-W stay north

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