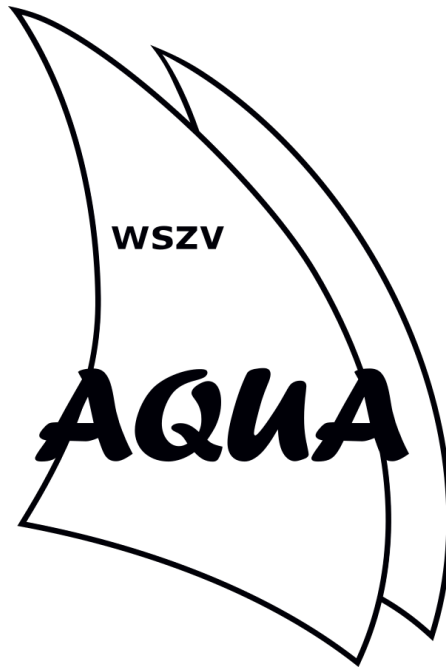


BOAT MAINTENANCE
THE COMPLETE GUIDE

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1. Introduction

Boat maintenance is an integral part of sailing at Aqua and has to be done every year. It ensures that the fleet remains in good condition and we can all enjoy sailing again next summer. To keep a well-maintained fleet, you need a productive winter season. Not only do you need to sand and paint, but also to make schedules, understand tools and the various parts of a boat, buy the right supplies and instruct others during maintenance. Good maintenance is a broad subject and requires a variety of skills to do well.

The 'lelievlet', the boat primarily used at Aqua, is the main focus of this book. It was designed by A.L.J. Stockmann, a skipper from the Titus Brandsma-group from Breda, and was based on a similar design from Teunis Beenhakker, who designed the 'beenhakkervlet'. Two test hulls were constructed by Beenhakker in 1956: one of 4.60m and one of 5.60m. From the two, the 5.60m version was deemed to be the most suitable and became the standard size for the modern lelievlet. The lelievlet became a great success for scouts and Sea Cadets alike, and over 1800 of them have been built to this day. The original lelievlet '1' still exists and is kept as museum piece at the Titus Brandsma-group in Breda.

Before the lelievlet, most boats used by waterscouting were made of wood, but this was labour-intensive to maintain and could easily damage. Steel was quickly adopted as the main material for the lelievlet. A modern lelievlet has a length of 5.60m, a width of 1.80m, a height (with mast) of 6.50m, an average weight of 650kg (casco) and a sail surface of 12.15m².

This book aims to explain *how* to conduct maintenance, but also tries to emphasise the *why* of maintenance. Why does paint rot?

Why do I need to clean a surface before varnishing it? Why do I sometimes need to yell at others to keep them safe? The reasoning behind the various tasks of maintenance is important to both do the maintenance as well as appreciate it. Understanding the effort you or others put in makes you more careful with the boat, which in turn means less maintenance next winter.

Maintenance work is skilled work, and while this book tries to cover all the aspects and details of maintenance, it can never replace experience and a good teacher. A lot of maintenance work requires a keen eye and some practical knowledge of the different manners in which a boat gets damaged during the summer season. Reading this book does not make someone an expert in boat maintenance, but it creates a solid theoretical foundation for learning the practical side of maintenance. This book is also a good reference book to consult when you are unsure how to complete a certain task, what to look out for during an inspection or when you need to remember which materials you need to buy.

Part I: Tools of the trade

This part covers the various tools you need for maintenance. This includes the practical tools such as sandpaper and brushes, but also how to make and work with a schedule, which is essential for good maintenance work. Every tool is explained, with details about their specifications and uses. Lastly, an example shopping list is given, detailing the supplies needed for one winters' worth of maintenance.

2. Scheduling

A good schedule is the first step in doing maintenance and should be made well before the start of the winter season. A schedule is essential in planning tasks and keeping track of what has been done, as well as communicating this to the rest of the association. Website events are made based on the schedule and labour-intensive tasks such as flipping boats need to be scheduled on a good day where many people can help out.

The winter season starts at the end of October or early November, depending how the calendar falls that year. It lasts for five months and the boats are placed back into the water again in early April, signalling the start of the summer season. The day when the winter season starts represents the deadline for earning participation points for that year.

Winter Season			Summer Season					Winter Season			
January	February	March	April	May	June	July	August	September	October	November	December
Extra time/woodwork Harder to get members			Boats back in the water					Create winter schedule		Boats out of water Preferred workshop period	

Overview of the summer and winter season months

A good thing to keep in mind is that the waterscouting works in shifts in the workshop, since the fleet is too large to fit in the workshop in one go. Aqua usually has the first shift, the first eight weeks before the Christmas holidays, to get the bulk of the maintenance work out of the way. Having to start up maintenance after the holidays often means less motivation and fewer people showing up, making it harder to work efficiently.

2.1 Making a schedule

A schedule does not need to be difficult. An overview of days and dates, along with which task has to be done on which day is usually enough. Add space to the schedule to put notes about the tasks by each day, in case something special has to be kept in mind. If the winter season has apprentices, add space for them to put down on which days they will help with maintenance. It is also a good idea to assign one person per maintenance evening who is responsible for the organisation and instruction of that night. You put their names in the schedule as well.

The winter schedule should be shared with the entire association, in a way that any updates to the schedule are visible without having to send another file. Putting the schedule in a cloud environment and sharing the link on the Aqua website is the best way to do so. Sharing a link to the schedule via WhatsApp is also a viable option.

There are many ways to design and organise a schedule, but at the core, most things stay the same. To give an idea of how a schedule should look and which tasks are done in what order, a sample schedule has been added below. This schedule can be copied and edited to suit your needs further.

Woodwork is integrated in the eight weeks you get in the workshop, but that does not mean it has to be done in that time. Woodwork can be saved for later if the casco needs more attention or if there are any delays, since the woodwork is not required to do in the workshop.

Keep in mind that during self-study and exam weeks, attendance will be much lower on maintenance evenings. Plan ahead to get bigger tasks out of the way and think of useful tasks that can be done with fewer people.

Week	Day	Task
1	Tuesday	Sand outer hull
1	Thursday	Prime outer hull
2	Tuesday	Tar first layer
2	Thursday	Tar second layer
3	Tuesday	Sand inside and gunwale
3	Thursday	Prime inside and gunwale
4	Tuesday	Paint gunwale and tar bottom
4	Thursday	Paint inner hull above waterline
5	Tuesday	Paint gunwale and tar bottom again
5	Thursday	Paint inner hull above waterline again
6	Tuesday	Start sanding woodwork
6	Thursday	Finish sanding woodwork
7	Tuesday	Owl's piss layer
7	Thursday	First layer of pure varnish
8	Tuesday	Second layer of pure varnish
8	Thursday	Extra time

Example schedule of an eight-week winter season. Holidays, study- and exam weeks are not included.

3. Tools

To do maintenance, you will need a variety of tools for sanding, painting and everything else. The O&ECie has a toolbox in the closet that contains basic tools like hammers and spanners, but for most of the work, other tools are needed that are often discarded after use, like brushes. This section lists and explains all the tools needed for regular maintenance and what to look for when buying them.

3.1 Tools for sanding

Sandpaper

Sandpaper comes in two types: dry sandpaper and wet sandpaper. Dry sandpaper is by far the most common type and is also the type we use on the boats and woodwork. Wet sandpaper must be used wet and is meant for polishing up steel or sanding delicate items where you do not want any dust.

Sandpaper is bought in rolls and comes in various levels of coarseness. The coarseness is shown as number that depicts the number of sand grains per square centimetre. Different numbers are used for different purposes. For a lelievlet, you will need 80, 120, 180 and 220 grid sandpaper. 80-grid is used for sanding out rough spots and treating surfaces. 120 is for lightly sanding painted surface to then put on new paint, not for removing paint. 180 is used for woodwork and varnished surfaces. Rough spots in the varnish are sanded with 120. 220 sandpaper is used for very fine sanding, usually on thin layers of paint when you want to remove as little paint as possible. Paint or primer put directly on bare steel is sanded with this fine grid, for example.

Scrapers

Paint scrapers are sharpened pieces of steel put on a handle, where the sharp edges are used to scrape off paint rather than sanding is. Scrapers are used to remove lots of paint quickly, but scraped spots must be sanded again to smooth things out. Loose flakes, paint rot and bad layers are best removed with a scraper.

Scrapers come in different shapes: triangular, square, droplet and 'flat'. Flat scrapers use replaceable razor blades and are not suitable for boats. Triangular scrapers are the most common but droplet scrapers are the most useful. They have a better point for picking out paint rot, a straight surface for edges and a rounded part for digging out scratches in the paint. Square scrapers are designed to work with straight corners, like window frames.

A scraper needs to be sharp and to be kept sharp. A dull scraper does not scrape as well as a sharp one and is also less safe to use. The edges of a scraper will 'mushroom', or curl, when you use them. These curls have to be removed regularly with a file or a whetstone to keep the scraper sharp.

Sanding machines

Sanding machines make sanding a lot easier and quicker, but are expensive and you will need many to give everyone one during maintenance. They also have to be used with a bit more skill, because it is easy to sand off too much or create dents and creases in the paint. Sandpaper is much cheaper and also easier to use, so give that to regular members.

Sanding machines come in three types: flat, orbital and multi-purpose, either with a cord or battery-powered. Orbital sanders spin continuously and at low speeds, and are designed for light sanding of large surfaces. For a boat, they are not useful nor powerful enough.

Flat sanders are powerful enough and make tiny circles to sand, rather than spinning. They use a clamp system or Velcro to attach sandpaper to it. The large, rectangular surface is useful for sanding the large, flat parts of a boat, but edges and hard-to-reach spots cannot be sanded well with a flat sander. A multi-purpose sander work in the same way but has a triangular shaped sanding piece. The sandpaper is attached with Velcro on a more malleable surface, so you can press the sandpaper into rough spots, pits and difficult-to-reach areas. It can also be used for flat surface, but the smaller size means it takes longer to sand a large area.

Sanding machines are for paint only, never use a sanding machine on varnished wood! The softer varnish comes off more easily and the rounded surfaces of the mast, oars, boom and gaff can get flattened by sanding machines. If you need to remove lots of varnish, use a heat gun and a scraper.

Rotating blasters

A rotating blaster is a disc that can be attached to a power drill and is designed to take off all paint from a certain area. The disc is made of rubber with small steel pistons on the edge. When spun against a surface, the pistons slam into the paint and break off the paint. This is a very aggressive way to remove paint and should only be done on the worst areas and by a skilled person. More often than not, a blaster takes off more paint than you want to take off.

When using a rotating blaster, keep a few things in mind. The disc works best when held at a ninety-degree angle to the boat, without pressure. The disc has to do the work. You cannot use the disc in corners and other nooks, since there is not enough room to spin the disc around. Lastly, the disc flings flakes of paint everywhere, so make sure to wear a good pair of goggles so they do not end up in your eyes.

Metal brushes

Metal brushes are named so because they are made of metal. They are used to brush off rust from the boat, which sometimes grows on painted surfaces, especially on the underside of the casco, near the centreboard swivel for example.

The brushes are made of two different metals: steel and brass. Brass brushes are used in one hand and are most effective at removing rust, but they wear out more quickly and you cannot put a lot of force on them. They are useful for edges and small bits, but not for larger areas on flat surfaces. For those, use a steel brush. They are stronger, last longer and the wooden handle means you can really push hard on them to remove rust from the boat.

For fragile parts or very thin layers, a brush can be too aggressive and damage the boat rather than fix it. In those cases, 40-grid sandpaper can best be used to sand off rust.

Heat gun

A heat gun is an electric tool that blows warm air between 100° C and 200° C. This heat is used to heat up paint or varnish and melt the coating, making it much easier to remove it. This is very useful on bits that are very difficult to sand or where the paint has turned gummy. A heat gun is also useful to remove stickers from a boat.

3.2 Tools for painting

Paints

Paint is provided by the waterscouting and ordered from a brand called *International*, which has a special series of paints meant for boats and other 'wet applications'. An overview of the different

kinds of paint and their unique codes is given in Appendix A. You only have to get the orange paint we use on the gunwale yourself. This is specially mixed at a hardware store like the Gamma. Get a lacquer paint for outside use in the colour 'Reddingsvest' (life jacket orange). About 500–750 millilitres of paint is enough for one boat in one winter. If the budget allows it, it is better to buy a more expensive brand of paint; the difference in quality and finish is substantial. Stay away from pre-mixed, extra cheap paint; while the price may be tempting, the paint can do more damage than good on your boat.

An international system exists for assigning code to different colours of paint, called RAL codes. These codes describe 2.528 different colours of paint and can be used to get specific colours at paint or hardware stores. The paints we get from the waterscouting all have a RAL code, but the orange paint does not. In case you need a paint with a RAL coat, you can find RAL colours online on <https://www.ralcolor.com/>. Online stores also sell 'holograms', a set of cards with coloured squares on them with the RAL code of each colour put inside. These are the most colour accurate examples of RAL paints.

Most paint cans are made from steel and have a steel lid. These can be opened by prying the lid of using a flat screwdriver or a special paint can opener. Be careful when opening paint cans, putting too much force on them can cause the lid to come off suddenly and splatter paint everywhere. To close a can, press the lid back down tightly on the can, where you have to make sure that the lid is closed all around. Next, put one hand on top of the lid and hold the entire can upside down. This causes a little paint to flow into the gap between the lid and can, which seals the can airtight when the paint dries. This keeps the paint inside from drying out.

Brushes

Brushes come in a large variety of shapes, sizes, uses and qualities, but for a boat you will only need a few various kinds.

Brushes can be split into two categories, depending on the kind paint they have to be used with: alkyd or acrylic. Alkyd paints are solved- or oil-based and the most common type of modern paint. All paints used on the boat are alkyd paints. Brushes for alkyd are usually marked with red on the handle. Acrylic paints are water-based and much less useful for boats, as the paint would dissolve during sailing. Acrylic brushes are marked with blue.

Brushes are made either flat or rounded. Flat brushes can be quite large, up to forty centimetres wide, but this is a bit overkill for a boat. Flat brushes are used with tar and varnish, sometimes for paint if there is little surface to paint. Mainly round brushes are used with paint and are used to get paint into places where a roller cannot go, such as the edges of the gunwale.

Brush sizes have a number, indicating their width or diameter in millimetres. For tar, use wider brushes of 60 millimetres, for varnish use 35 or 40. For paint, use round brushes of size 15. For painting letters or placing markings on woodwork, use round brushes of size 6 or 10, depending on the level of detail you want.

The quality of brushes is often but a small factor in choosing which to buy. Higher quality brushes leave a neater finish and have a smooth brushstroke, but are more expensive. Lower quality brushes are much cheaper but can leave stripes in the painted surface because of the thicker, rougher hairs. Cheap brushes also tend to leave hairs behind, which can end up getting stuck in your paintwork, so be careful not to leave any behind. For special jobs or detail work, it can be worthwhile to buy one

or two high quality brushes. For the rest, just use the cheaper brushes; You will need many so it can save a lot of money.

Brushes can be stored after use, so they can be used again at another time. Put the brushes in a mug or jar filled with ample water, to keep them from drying out. Do not put brushes used with different kinds of paint in the same container. When you want to use the brushes again, take them out of the water and wipe them thoroughly on a cloth or towel to drain all the water out. If the brush no longer gives of colour and moisture, it can be used again. Brushes for varnish can be stored in the same manner, but they have to be stored in turpentine, not water. Wipe them extra thoroughly, because leftover turpentine can dilute the new varnish.

Rollers

Paint rollers can, as the name implies, be used to roll paint over a surface, rather than using a brush to spread it out. This leaves a nice, even and thin coat of paint, but can only be used on flat surfaces. Edges and different shapes will still have to be brushed.

Rollers come in two types: hairy and spongey. Hairy rollers are meant for latex paints that you put on walls, not for boats; use the spongey rollers for that. They come in different sizes, but the standard size is 10 centimetres. This is big enough for boat-work.

Rollers need a bracket to put them on, sold separately. Always check if you have brackets left before getting new ones; you can always find a few in the workshop if you need more. The internal diameter of most rollers is the same, so you don't have to worry about fitting rollers on brackets of different brands.

Rollers are only used for paint. Varnish should always be put on with a brush, because it is a different type of coating, and tar is

too thick to roll out. Use a brush for tar, more as a putty knife than a brush.

Unlike brushes, rollers cannot be soaked to store them and use them again later. This is possible with hairy rollers, but not spongy ones. After using a roller, throw it out and use a new one next time.

Masking tape

Masking tape is a cheaper kind of tape made of paper that is used to cover up parts where you don't want paint to end up. It can also be used to create crisp, straight lines in your paintwork. Masking tape can be bought cheap and in various widths, but a standard 30 millimetre width is plenty. Store masking tape in a warm and dry place, otherwise the glue in the tape will spoil.

Trays

Paint trays are plastic containers to put paint in for when you are painting, so you do not have to work straight from the can. They have a deep end for paint and a shallow end with grooves to brush of your brush or roller from excess paint. Trays come in different sizes to accommodate different roller sizes, but a standard size of 15 x 28 centimetres is big enough and fits the standard 10cm rollers nicely. These trays also have disposable, thin inserts. These are cheap and mean that you can use your trays multiple times and with different kinds of paint; you simply replace the insert after use.

Varnish is poured in jars or cups, not trays, because varnish has to be mixed with turpentine and this is much easier in a jar of cup.

Thinners

Since all paints used for a boat are alkyd, you need paint thinner to thin your paint. You will almost never have to thin paint, but it can be useful when the paint is old and a bit dried up, or if you want to make paint a bit more viscous to get it into dents or hard-to-reach places. Varnish also needs to be thinned with a thinner, not water, to make different mixes for different purposes. Use plain turpentine (sometimes called white spirit) to thin paint. Do not store used brushes in turpentine, use plain water for that.

Paint stored in a cold place can become thicker from the temperature. Heating up paint gently on a radiator can help make paint more viscous and leave a nicer finish.

Cloth

Scraps of old but clean cloth are useful to use as towels and as dust cloths. Almost all cloth can be used, like tea cloths, t-shirts, bedsheets etc. Check that the fabric is made of cotton or linen; synthetic fabrics resist moisture and do not absorb dirt and dust as well. For dusting, you can also buy a pack of yellow cleaning cloths and rinse them out after use.

3.3 Safety equipment

Goggles

A pair of safety goggles is not necessary for most maintenance work, such as sanding and painting. However, sometimes a task needing doing that do require safety goggles, such as rigorous scraping or working with a rotary blaster. Protective glasses are most often more than enough, but it can be useful to have one or two pairs of proper goggles that fit closely to the face, so there is no chance of something to get into your eyes.

Gloves

Protective gloves are also optional for maintenance, but can be useful when working with sharp things, power tools or with a sensitive skin. Regular gardening gloves are suitable for almost all tasks. A box of latex gloves is cheap and can be useful to hand out when painting, so people's hands do not get dirty. When sanding, it is inadvisable to wear gloves, as you have less grip on your sandpaper and you cannot feel the edges of rough spots properly.

Face masks

Face masks (for dust, not diseases) are very important in keeping dust, rust and other nasty substances out of your lungs. It is the responsibility of the O&ECie to provide every member who comes to maintenance with a face mask. Face masks come in many different forms, from simple paper masks to full face masks with a filtration systems attached to your belt. The best face masks are those with two elastics, a metal strip to fit the mask to your nose and the FFP1-certification. These can be bought reasonably cheap at any hardware store. Buy plenty, as they will keep until next winter. Have every member you give one write his or her name on the mask with a permanent marker, so you can save them at the clubhouse for the next time they do maintenance.

Overalls

Overalls are only worn regularly by the O&ECie during maintenance evenings, but there is no rule that others should not wear them. An overall is a great garment for making sure you and your clothes stay clean, as well as keeping you warm during the cold winter nights. If you or other members want to buy an overall, the only thing you have to make sure of is that it is made of 100% cotton. Most overalls are for gardening and are made

with a polyester-cotton blend, which can melt if it burns. Using tools on steel that create sparks can carry a (very small) risk of setting fire to your overall and molten polyester can do serious damage to your skin. Also make sure that you do not put a dirty overall in washing machine. The dirt that comes out of the overall can damage the machine or spread onto other clothes washed in the same machine.

3.4 Miscellaneous tools

Spanners

A solid set of spanners of assorted sizes is essential for any task that deals with bolts. Bolts are found in the rudder and on the mast, parts that stay outside for the entire summer and are prone to rusting tight. A spanner combined with a wrench can unscrew almost any rusted bolt. In case it still does not want to open, spraying a little WD40 on it may help, and so does heating the bolt with a gas lighter. Mind you do not burn the wood when doing so.

Pliers

A solid pair of combination pliers is a very useful tool for almost all applications, from unscrewing bolts and bow shackle, to pulling out nails or picking up very small parts. Make sure to get a good brand when buying pliers; cheap pliers tend to be made of inferior steel and can break when you put too much force on them.

Wrenches

An adjustable wrench allows you to change its diameter to fit bolts of almost all sizes. The longer handle allows you to put considerable force on the bolt or nut. In combination with a

spanner to counter-twist, this pair of tools can get almost any bolt unstuck.

Permanent markers

Permanent markers are used to put waterproof writings on parts and labels. When disassembling the boat, or a part of it, use masking tape to give each part a label, then write the name and location of the part on the tape. Permanent markers are also used to write names on face masks.

Chalk

Regular board or pavement chalk is useful for drawing circles around spots that need more attention. The chalk leaves a clear mark on painted surface and can easily be removed by sanding or with a wet cloth, leaving no mark behind. A set of various colours can be useful to get a good contrast on different colours of painted surfaces, but white chalk works with most colours.

Soap

A good soap is useful for cleaning your hands after maintenance, keeping them clean and getting rid of paint, tar or varnish that you got on your hand. A pumice soap has a sand-like texture that can scrape of paint from your hands. Regular dish soap and a towel also go a long way in cleaning of paint, at the cost of the towel. You can also clean your hands with turpentine or benzine, but putting more chemicals on your skin is not advisable. If you do it, clean your hands well afterwards with water and soap to rinse of the spirits.

4. Shopping list

Before the start of every winter season, supplies need to be bought to do maintenance with. This goes for disposables, such as brushes, but also for things that keep longer, like marling line, turpentine, and painting trays. Use the list below as a guideline for which things you need to buy and how many you will need. Before you make your list, check what you currently have and if it is still in usable condition. Some things like masking tape can ‘spoil’ with moisture and frost and may not be usable again. Brushes, rollers and face masks can be easily be stored and used again next winter, if unused.

The quantities given with the list are also a suggestion for how much you need when you do maintenance with four people. If you expect more or fewer people showing up for certain activities, you can anticipate and buy more or less of certain items. You can always get more supplies if you run out, but make sure to check in advance if you have what you need for the next night. Planning ahead will keep your stocks from running out!

4.1 List of items

Must be bought every winter:

- Nylon cord, white, 6mm, 25 mtrs (for marling)
- Brushes
 - Round, 15mm, 16 pcs
 - Round, 6mm, 4 pcs
 - Flat, 60mm, 8 pcs
 - Flat, 35-40mm, 12 pcs
- Rollers, 10cm, 20 pcs
- Mixed lacquer paint for outside use, orange, 500-750 ml

Check if you still have it, otherwise buy:

- Sandpaper
 - 80 grid, 3 rolls
 - 120 grid, 3 rolls
 - 180 grid, 2 rolls
 - 220 grid, 1 roll.
- Masking tape, 30mm, 2 rolls
- Turpentine/white spirit, 1 ltr
- Permanent markers, 2 pcs
- Cardboard cups or jars, 10 pcs
- Droplet scraper, 3 pcs
- Face masks, FFP1, 25 pcs
- Roller brackets, for 10cm rollers, 4 pcs
- Chalk, coloured or white, 1 box.

Optional

- Sandpaper for sanding machines
- Yellow cleaning cloths
- Nuts and bolts for mast and tiller.
- Bow shackles (buy from Toolstation)
- Latex gloves, 1 box (about 200 gloves)

Part II: Casco

‘Casco’ is a Spanish-derived word for the bare hull of a boat or ship. In our case, it refers to the main steel part of a lelievlet. The casco needs to be properly checked, sanded and scraped, then primed, tarred and painted. This forms the bulk of maintenance work every winter and requires a keen eye to do properly. The art lies in spotting rough spots and paint rot, then knowing what to do about those issues. Painting over untreated damage only isolates the problem, where it will fester and come back twice as hard next winter.

5. Sanding

In this book, sanding is used as an umbrella term for all steps to prepare the surface of the casco for new layers of paint and tar. It also involves brushing, scraping and cleaning the surfaces.

The purpose of sanding the boat is to prepare the surfaces for new layers of paint and tar. Damages have to be repaired or removed, rust must be treated and the good paint must be roughened to make sure that the new paints sticks well on the casco. The rudder and centreboard are sanding and treated in the same way as the casco.

5.1 Inspection

Before you start working on the casco, conduct a general check-up of the whole boat to get an idea of the condition the boat is in. Check both by eye and by feel for dents and scrapes, bare steel, rust and paint rot. Give extra attention to places where it is more difficult to sand or paint, such as the inside of the centreboard box, underneath the framework, in the corners of the decks, thwarts and in the edges of the gunwale.

Rust can easily be recognised by its bright orange colour and the forming of crusts, that turn into a fine dust when you give it a quick brush. Darker and more subtle forms of rust exist; this kind is mostly found on bits that have recently been scraped bare and have only recently started rusting. It often appears in the centre of rough spots.

Paint rot occurs when moisture has crept underneath or between layers of paint and has festered there, oxidising the paint and stopping the layers from sticking two each other. It appear in two kinds: damage rot and soak rot. Damage rot appears in places where the boat has been damaged, so it is easy to spot. The paint is damaged and cracked, breaking the smooth surface of the top

layer of paint, which can allow water to creep in between the underlying layers. Check whether you can pull flakes of paint off by hand at rough spots. If you can, that indicates paint rot, which should be scraped off before sanding.

Soak rot occurs in places than stay underwater for long periods of time and so it mostly appears on the bottom of the boat (inside and outside). The paint stay wet for so long that it weakens and slowly lets water through. Serious soak rot can affect large areas and many layers of paint, even all the way to the bare steel. Since it does not require damage to happen, it can be harder to spot. Paint affected by soak rot will swell and form bubbles. If you press into the bubbles, they will be a bit squishy. Use a scraper to hack into the bubbles a bit and large chunks of paint should come out easily. If you find soak rot, scrape it very thoroughly to get all the rotten bits of paint out. A heat gun can be of great help here, especially is the rot appears in hard-to-reach places such as the corners of the skeg.

5.2 Scraping paint rot

Paint that has rotted is damaged paint and should be removed. Use a sharp scraper to remove all the loose flakes or chunks of paint and do not be too careful when doing so. Better to remove a bit too much paint and be sure you are back on good paint, than to take of too little and paint over bad paint. Be even less careful when you work with soak rot, which can affect larger areas and many layers of paint. Really get in there with a scraper and a heat gun to get all the bad paint out.

Parts that have been scraped will need to be sanded flush before putting new paint on it. When scraping, you are basically creating a new rough spot.

A special case for scraping is the inside of the centreboard box. This place is too narrow to put fingers and sandpaper in, so the

only way to clean it out is by using a long, narrow scraper. Before you start scraping, use a flashlight to look into the centreboard box to assess its condition. Only scrape the worst parts clean as well as you can. It is fine to leave some rust, dirt and rough spots on the inside, since you can never get it as clean as you would like it to be.

5.3 Brushing rust

Rust occurs on bare steel where the paintwork has been damaged enough to reveal it. Use a metal brush to brush off all the rust you find. The steel is clean again once it turns silvery and shiny. If the tarred parts of the boat have many layers of tar on them, it is better to brush that as well rather than to sand it. That way, you get rid of all the oxidised paint that develops on the boat, but which you cannot see. If the tarred layers are very thin (e.g. with a new boat), brushing can be too aggressive and remove the tar entirely, rather than clean the surface. In those cases, sand the tar like you would with paint.

5.4 Sanding rough spots

A 'rough spot' is any spot where the paintwork is damaged that does not fall under the categories above. You can spot rough spots by looking for damages or places with a distinctly different colours, but it is better to 'feel' rough spots. Any spot that has a feelable edge where you can pluck at with your nails needs sanding, to make it all smooth again. Use 80 grid sandpaper to sand rough spots smooth.

Finding rough spots takes skill, even though most of them are quite obviously placed. Rough spots can be very tiny and hidden away in places you cannot see, only feel. Take your time to study an area well, and look, feel and pluck around for rough spots. If you are unsure, better to sand it than to leave it.

5.5 Sanding surfaces

By surface area, by far the largest part of the paintwork will be undamaged and intact and will not require scraping or brushing. It still needs to be sanded, but only to roughen up the surface to make sure the new layers of paint stick better to the surface. Use 120 grid sandpaper to lightly sand the surfaces.

6. Priming

Primer is a type of paint that is designed to be a base layer between a solid material and the final coat(s) of paint. It serves multiple purposes: the primer can stick well to bare materials and older paint, creating a solid foundation to then put on a different paint, which might not stick easily to bare material (especially so in the case of steel). The primer also ensure that the layers underneath do not show through when the final paint is put on, so the colour is even, and every part is well covered. Lastly, primer is useful for filling up dents, nooks and crannies created by sanding and scraping, making the surface smoother.

The primer provided by the waterscouting is called Interturf 203 Aluminium and has a silver colour (see Appendix A for details). Mix the primer well in the can with a mixing stick before you pour it into a tray. Use the 15mm round brushes to put the primer on the boat. Dust and clean the surfaces well before you put on any primer.

Primer is expensive and it is unnecessary to put it on undamaged paintwork. Instead, use a brush to put little bits on all the sanded rough spots and the parts that are more prone to rot and damages, like edges, corners and tubes. The larger surfaces often need little

primer, so save yourself time, effort and paint when priming those.

Places that are very badly damaged can be primed twice, to give it more protection and a better base for the next layers of paint. Places that have been affected by soak rot or bits of steel freshly welded into the casco can always use a second layer of primer. Wait for the first layer to be dry, then lightly sand the primed spots with 120 grid sandpaper. Dust and clean the spots, then put on the next coat.

Give the inside of the centreboard box a full layer of primer. This part is very hard to sand and thus more prone to rust and damage than any other spot on the boat. Use a roller on an elongated bracket to get inside the centreboard box. Use a flashlight to check if you have been everywhere. Take off your shoes when you stand on the boat, otherwise you bring dirt and dust back onto the surfaces you just cleaned, ruining the primer you put on.

7. Tarring

What we call tar actually isn't tar. Real tar is a thick substance made by 'melting' coal or charcoal to create tar (or pitch), but is now regulated to use for boats, as it has a serious effect on water quality and ecosystems. The 'tar' we use is actually just a very thick paint, that has been made to resist water and form a strong insulation layer for parts of the boat that stay underwater for long periods of time. The tar provided by the waterscouting is named Interturf 16 Black, has a black¹ colour and comes in very large buckets. The tar is very thick and is painted on with a 60mm

¹ Tar is technically very dark brown.

flat brushes, which are used more like putty knives than brushes. You can pour the tar into a tray or work straight from the can, but be careful that you do not get dirt, water or other impurities in the tar.

Before tarring, lightly sand any places that you primed beforehand, then dust and clean the entire surface with a damp (not wet) cloth to remove all dust. Start by tarring the inside of the centreboard box; take off your shoes when you stand on top of the boat. This is also done by using a roller on a longer bracket. Put the rest of the tar on from the front to the rear and create an even layer that has a good coverage. Divots can be filled by making circular motions with the brush while holding it upright. Remember to also tar the rudder and centreboard.

When tarring the inside bottom of the casco and the sides of the centreboard box, use masking tape to create a crisp line between the tar and blue paint. When you are done tarring, peel off the tape right away; do not let it sit while the paint dries. Work from the front to the rear and do one 'square' at a time. When moving to a new square, first tar the underside of the framework before you tar the rest. Cleaning the inside can be difficult, because you cannot sweep the dust on the floor. A pan and duster helps, but a vacuum cleaner helps even more. The waterscouting should have one. When working on the inside, take off your shoes and place them near the quarterdeck. On your socks, you will not take more dust back into the boat. Make sure to wear some extra thick socks for warmth, that also are not your nicest.

Tar takes about 48 hours to dry and harden before you can put on the next layer. Lightly sand the surface with 120 grid sandpaper, then dust and clean the surface again. Put the second layer exactly as you did with the first, starting with the inside of the centreboard box, then working from the front to the rear.

8. Painting

While painting is also a term usable for primer, tar and varnish, in the context of this book it specifically means applying (lacquer) paint to the boat. The decks, chine, centreboard box and gunwale must all be painted. Three kinds of paint are used. The decks and chine are painted with Interlac RAL 5003, which is a bright blue paint. For the gunwale, the first layer uses Interturf 262, a white paint. This is followed by the final coat(s) of orange lacquer paint that you have mixed yourself.

This sections assumes that the area you want to paint has already been sanded, primed and cleaned, as described in section 5, 6 and 7. Just as a quick recap: the area you want to paint should be thoroughly checked and sanded, cleaned and primed, then lightly sanded and cleaned again. The surface is then ready for new layers of paint to be added.

The chine, decks and centreboard box can be painted with pure paint. Open the can and mix the paint well. Be sure to get into the bottom edge to get all the sediment from the bottom of the can. When the paint is mixed, pour it into a tray to work from. Prepare round brushes with diameter 15 and rollers on regular brackets. With painting, divide the people into brushers and rollers, where you have about three brushers for every two rollers. The brushers lead, painting the creases and the parts that are too small or tight for a roller. The rollers follow and fill in the larger flat surfaces. The rollers follow the brushers so they can smooth out some of the brushwork and catch drippings. Paint the chine up to the upper edge of the gunwale, where the plate transitions into the tube. Make sure to fill the welding gully with paint. Tape off the bottom, over the tarred area, to make a crisp line. The line should at or slightly above the height of the

framework for the decking. Remember to take off the tape right after painting.

For the second layer of blue, lightly sand the surface with 120 or 180 grid sandpaper and dust thoroughly with a damp cloth. Tape the bottom off again with masking tape.

The gunwale is painted with two different kinds of paint. The first layer, after primer, is a mix of white and orange paint. The white paint is of higher quality than what you can get (cheaply) at a hardware store and forms a better protective layer against the elements. A bit of the orange paint is mixed in to make the colour closer to orange, since white easily shines through other light colours painted over them. Mixing in the orange also means mixing two different kinds of paint, which improves the adhesion of the final orange layer. Mix orange paint with the white paint in a ratio of about 1:4, but there is no need to measure. Mix the paint in the tray, not the can, or get a separate jar to mix in and then pour from. The mix should be slightly orange or beige.

When painting the gunwale, tape off the blue chine on the inside, just below the welding gully. This allows you to refill the welding gully with paint and put extra layers on it. The welding gully is very difficult to sand, so putting extra paint on it is always helpful. It is also not necessary to tape off the tarred underside. If you do not paint over the strake, no paint should come on the tarred parts. Again, remember to remove the tape right after painting.

Between 'white' and orange, be sure to lightly sand the former and clean it again with a damp cloth. Use 120 or 180 grid sandpaper for sanding. Tape off the chine again and put on one or two layers of orange paint, depending on how well the coat adheres and covers the white colour underneath.

Tar is very thick, and primer is only put on small areas, so the risk of dripping is very low. When painting larger areas, this risk increases, so continually check your paint for thicker bits that have started dripping. Use a brush to spread out the paint better. If a drip has gone over to a different dry part of the boat, use a cloth to wipe off the paint, quickly. Drippings that are not removed dry up and form little bubbles of paint. Not only is this visible and untidy, the bubbles almost always cause paint rot, meaning that they will need to be scraped and fixed next winter.

Part III: Woodwork

The woodwork of a boat, the mast, oars, benches, decking, boom, gaff and tiller, form the second biggest part of maintenance. These must also, like the casco, be checked, sanded and then varnished. The trick of varnishing lies in mixing varnish with turpentine with varying ratios; each mix being used for a different purpose. Wood is also a material that responds differently to water and moisture than steel, although the same factors affect it as steel. Wood 'works' and can rot, which needs to be treated. Remember, wood cannot be shaped, only guided.

9. Sanding

Sanding and scraping varnish work in the same way as with paint and tar but uses finer sandpaper since varnish and wood are softer materials and less varnish needs to be taken off. Sand the good surface with 220 grid just to roughen up the surface. Sand the rough spots and spots you have scraped with 180 or otherwise 120 grid sandpaper.

9.1 Inspection

The first point of business before sanding is a good check-up, just like when sanding the casco. One advantage of the woodwork is that it changes colour when it is affected by water or when air has gotten underneath the varnish. The wood turns dark brown, sometimes with a white edge. Damage can also be felt more easily; damaged varnish tends to chip more easily than paint and so comes off more easily. Pick at discoloured spots with your fingernails quickly reveals where you need to sand or scrape the varnish.

Some places, like where the gaff swivels on the mast, are damaged continuously during use and the varnish wears out more quickly. The foot of the mast has straight corners where the layers of varnish come apart more easily and water can creep in. These places will always need a good sanding and be checked for wood rot. It can be very useful to use a heat gun and a scraper to get rid of all underlying varnish and start from bare wood again. That way, you can be sure that the new coats of varnish adhere properly and nothing festers underneath it.

9.1.1 Wood rot

Wood rot comes in two variants, brown rot and white rot. As the name implies, the colour shows what kind of rot is affecting the wood. Which type appears is determined by the kind of

mould that is affecting the wood. Brown rot is by far the most common type to appear in the mast, boom and gaff, as they are made of Oregon Pine wood. White rot is more common on the oars and tiller, which are made of ash wood, but brown rot can appear here as well. The thwarts and decking are made from Meranti, a tropical hardwood that is very resistant against friction and water. Rot does not quickly set in here, but if it does, it is brown rot more often than not.

When you encounter wood rot, it must be treated before you varnish it again. Use a scraper and a heat gun, if necessary, to remove some varnish around the rotten bit, so it is surrounded by good wood, without varnish. If the rotten wood has turned brittle and it crumbles when you poke around in it with a screwdriver, use a pair of pliers to pull out any loose and brittle bits. Next, apply a wood rot impregnation liquid, which you can buy at a hardware store, on the rotten wood, following the instruction on the bottle. When the wood is treated, you can fill any cracks and gaps with either wood putty or a mix of sawdust and wood glue. When dried, it fills the gaps left behind by removing the rotten wood and both seals and strengthens the wood. From there, the treated parts can be varnished as if it were bare wood. If very large pieces of wood come out and the hole is too large to fill with putty, you can use a sharp chisel to smooth out the edges of the hole and then glue a new piece of wood in. Fill the gaps with putty and sand the new piece flush with the woodwork. Old screw holes can be drilled out with a bit wider than the hole, then filled up with glue and a wooden plug.

9.2 Sanding

With any wood rot treated and bad varnish scraped off, the rest of the woodwork can be sanded. Surfaces without damage, where the varnish is still intact and has not changed colour, only have to be lightly sanded to rough up the surface. Use a fine 220 grid

sandpaper for this and only sand enough to take of the shine of the old varnish and smooth out any sandy textures you feel.

Spots that have been scraped and other rough spots have to be sanded smooth, just like when sanding paint. Use a coarse 180 grid, or 120 grid for the worst spots, to smooth everything out. Make sure to also sand the tops and bottoms of the mast, boom and gaff. Old varnish can sometimes develop a sand-like texture that is rough to the touch. Use 220 or 180 grid to smooth this out as well, otherwise it will be noticeable through the new layers of varnish.

Old markings placed on the woodwork do not have to be specially treated. They can be sanded like they are regular varnish and when clean, be varnished over. They might turn a few tints darker.

One advantage of having to sand woodwork is that you can take the parts outside, rather than sand them indoors. This will help a lot in dispersing dust and helping to keep the woodwork cleaner during sanding. You also will not have to wear a face mask if you sand outside. Do be careful of rain. The water will seep into any bare or untreated wood. Wet wood has to dry out first before you put any varnish on them, otherwise you trap the moisture inside the wood.

9.3 Ironwork

The mast and boom have metal parts screwed into them, to attach the sails, halyard and shrouds to the mast or boom. Once every few years, these metal parts must be removed from the woodwork to inspect the wood underneath. Varnish tends to gum up underneath the ironwork and they might be stuck the wood, so be careful when prying them off. The screws and screw holes also need to be checked. The screws tend to rust more quickly and need to be replaced. The screw holes can attract

wood rot and should be drilled out and plugged every few years. The holes can then be redrilled.

It is often best, and necessary, to get rid of all the varnish underneath the ironwork and start from bare wood again. Use a heat gun along with a scraper to get all the varnish off.

The ironwork is put back on after varnishing all layers. This can mean that putting them back on can be a tighter fit and you may damage the varnish a bit. This is not a problem, but when the ironwork is put back in place and is screwed on tight, put some varnish over the edges so the varnish seals the ironwork and prevents water from creeping underneath it.

9.4 Cleaning

When sanding, varnish produces a finer dust than paint. This dust tends to get into crevices and clothes more easily, meaning that when you clean the woodwork for varnishing, you must be extra thorough to get all the dust off. A damp cloth will get most of it off, but using a dust brush will let you sweep out dust from rough spots and holes, making sure you get everything out.

10. Varnishing

The key to varnishing wood is to work in stages, where each stage uses a different mix of pure varnish and turpentine to dilute the varnish. Thinner varnish flows easier and can seep into the wood, which acts as a kind of impregnation, protecting the wood itself. Pure, or near-to-pure, varnish is thicker and less viscous. It takes longer to dry but forms a smooth and shiny final layer, that protects the wood against moisture and scratches.

Mix varnish by pouring pure varnish into a jar or cap, then gradually add turpentine until you get the right consistency. Mix the varnish well in between adding turpentine with a mixing stick.

An important note: when varnishing the oars, the handles have to stay bare. Putting varnish on them is not a disaster, but rowing with varnished handles will cause severe blisters. If someone by accident puts varnish on the handles, use a heat gun to get it off, then sand the handle smooth with sandpaper.

10.1 Owl's piss

'Owl's piss' ('uilenzeik' in Dutch) is the comical nickname used for the thinnest mix of varnish used. To make it, you mix varnish with turpentine in about a 1:1 or 3:2 ratio, depending on how thick the pure varnish is. The mix is right when it is just a bit thicker than water. This thin mix is used as the base layer for older and new woodwork and can seep into the wood to protect it at a deeper level. Parts that have been varnished before only need one coat of it, but spots that have been sanded bare can use more; two or three is good, but if you have the time to add more, it does not hurt. Sand very lightly between layers, using 220 grid sandpaper. Thinned varnish is more likely to form a sandy texture when it dries, so sand that gently smooth before putting on more varnish. Clean the woodwork with a damp cloth after sanding.

Wood that has never been varnished before needs at least three coats of owl's piss before putting on any thicker layers of varnish. Softwoods, such as the Oregon Pine used for the mast, boom and gaff, should also first be impregnated with a protective liquid specially made for this purpose. This usually works the same as using thinned varnish; you brush it on and sand lightly between layers. Read the label for instructions.

Owl's piss is a very thin and thus runny liquid, meaning it is very easy to get drippings, especially on round parts like the oars, mast or boom. Keep a cloth ready to wipe of any drops and drippings that form on the woodwork.

10.2 Medium blend

The medium blend comes after the owl's piss and is mixed to a ratio of three parts varnish to one part turpentine. The consistency is still thick like pure varnish, but a little more viscous and smoother to brush. This mix is meant as an in-between before putting on pure varnish. The thinner viscosity means that the mix can more easily get into the gaps and spots that have been sanded, ensuring that every bit of the woodwork is covered with at least one layer of varnish. Thinning the varnish is meant to improve the flow of the varnish, not to get it to seep into the wood.

One layer of medium blend is enough for pre-varnished woodwork. For new wood, put on two coats. Again, lightly sand and clean in between, and sand out any rough sandy texturing.

10.3 Pure varnish

Pure varnish forms the final protective layer on the woodwork. It does not need to be diluted and can be put directly onto the woodwork, after lightly sanding and cleaning. Put extra attention into cleaning before putting on the varnish, as this final coat will also determine the final look and feel of the woodwork. Keep an eye out for drippings, especially on the undersides of the round parts, such as the mast, oars, boom and gaff. Give the final layer at least 48 hours to dry and harden, before putting on a second layer, if desired.

Part IV: Miscellaneous

There are a number of miscellaneous tasks that must be done during the summer and winter season that do not form a part of 'regular' maintenance. Most of these tasks only have to be done once during the winter and sometimes only once every few years, but because they are still important, they have a place in this book.

11. Day-to-day maintenance

During the summer season, a few small jobs need to be done every week after sailing. Most of these tasks have to do with keeping the material in good condition throughout the summer season, thus minimising the risks of developing rust, wood rot or damage to the sails and lines.

The biggest task is keeping the different materials as dry as possible. Bail water out of the boat every time you go sailing, before you set off. When you are done, hang wet sails and sail covers to dry inside the clubhouse, using the hooks placed on the ceilings of most of the rooms and hallway. Lift the decking out from the bottom and place them on top of the thwarts and decks; this keeps them away from the bottom of the boat, where they can be submerged in water when it rains a lot. This allows them to dry and prevents soak rot from developing.

It is also good to clean the boat every once in a while. Dirt, leaves and rubbish can grind on the paintwork or start rotting and affect the paint. It also prevents the filthy parts to dry completely after rain, allowing soak rot to set in more easily. Pour water over the decks and use a cleaning cloth to wipe down the decks, chine and gunwale. Pull dirt and leaves out of the scuppers so water can easily flow off the decks. The sails also need to be cleaned every once in a while. Find a good place to lay them out, like a large table and wipe out any stains and dirt with a damp cloth. Hang the sails to dry afterwards. Look underneath the decking for dirt, leaves and garbage and clean the bottom out as well.

Once every month, do a quick inspection of the condition of the boat, especially any small parts. Check if there are damages to the paint on the casco and woodwork and try to figure out what

caused them. Check the condition of the shroud for rust and kinks and tighten all bow shackles with a pair of pliers.

12. Dis- and reassembly

At the start of the winter season, the entire boat has to be taken apart, before it can be hoisted up on shore. At the end of the winter season, the boat has to be put together again in exactly the same way. The important thing is to label every part you take of of the boat, so you will still know what it is at the end of the winter.

Take everything out of the boat and put a label on it. Bigger parts like the thwarts or decking may not necessarily need a label, but smaller parts like the bolts for the mast, halyards, sheets and tiller most definitely need a good label. Put the name of the part and the boat number on the label, as well as which side it came from. Remember to also take of the mooring lines (as many as you can), spring lines, fenders, rudder and sailstand. The more you can take off and store, the less things you may end up losing. Take the rudder and sails apart, so you have the different parts separated.

Everything has to be stored in a dry and preferably warm place where it will not freeze. Put the sails in a solid crate with a lid. Coil the lines and put these in a good crate as well. This keeps both moisture and vermin out during the winter. The shrouds have to be coated in a layer of petroleum jelly and then stored in an airtight plastic bag. This keeps rust from forming on the cables and also keeps them supple. Put small parts such as pulleys, bolts, nut and marling lines in a bag or box, so you do not lose them. Again, the important part is to label everything properly.

When the boat has been placed but into the water, you should be able to find all the parts of the boat back again, and know exactly where to put them. During reassembly, check any bow shackles and bolts for rust and damaged, and replace them if necessary. Tighten bow shackles that go out of your reach, e.g. in the top of the mast, with pliers, so they are less likely to come apart on their own.

13. Placing markings

A marking is a coloured stripe or squared place on the oars, thwarts, decking and tiller to indicate they are from the same set. The Aegir had orange markings, Rán has gotten blue markings, made with the same paint as the chine and decks.

A painted marking is put on top of the layers of varnish underneath. When you varnish over a painted marking, the colour might darken. Blue paint could turn black and can thus cause mix-ups.

Use masking tape to set up an area which you will paint. On the mast, boom and gaff, this is a ring on the round part of the wood. On the oars and tiller, the ends are painted in their entirety. Sand the area lightly with 220 grid sandpaper, while keeping the tape on. This will prevent scratches on varnished area where you do not want to paint, keeping the transition clean. Dust and clean the sanded area and paint one layer of paint on it, with a brush.

Markings on the decking have to done more carefully. The texture top planks cannot be taped of very well and paint can creep through the gulleys underneath the tape.

Place the markings on the thwarts and decking in such a way that they work to your advantage. On the thwarts, place the markings

both on the starboard side and only on the top. Then you will always know how they are supposed to go in the boat and you can save time puzzling with them. The same goes for the decking. Put the markings all on the central inside corner, so you can quickly place them as well.

14. Painting names and numbers

According to the RPR, any boat sailing on the Rhine must have its name and home port written on the hull. This also applies to the boats from Aqua. Names are painted on the gunwale; the name of the boat goes near the front, the name of the home port goes at the rear.

Painting letters is not very difficult, but it requires a steady hand and some preparation. Use a permanent marker to draw the outline of the letter on the gunwale, preferably using a stencil. Always work from the ends towards the middle of the boat, so you are always sure you have enough space for the whole text.

You do not need to sand the letter before painting them on, as they are purely decorative and will have to be removed next winter anyway. Use a round 6 mm brush and the regular blue Interlac RAL 5003 (assuming the gunwale is painted orange). Use the paint sparingly and work from the ends of the letter towards the middle. Keep a cloth at hand to remove drippings. The important thing is to not rush it and take your time.

Every lelievlet ever made has its own registration number. For certain events and regulatory systems, this number also needs to be visible on the boat. Numbers are painted in the middle of the gunwale, in the same manner as letters. The number of Rán is

1817; this is also engraved on the thwarts, decking, centreboard and rudder, as well as printed on the mainsail.

Special stickers exist specifically for the names of boats. These can be designed and printed at many online stores. Nautical stickers are put one using water and a special scraper to create a vacuum underneath the sticker. No glue is needed for this. Any stickers can best be removed using heat, either from a hair dryer or a heat gun. The stickers will then be easy to pull off. To put the stickers on well, the surface of the boat needs to be flat and smooth. While this is easy on new boats, older boats tend to have dents and uneven surfaces, making it much more difficult to put the stickers on correctly. In those cases it is better to paint the names on.

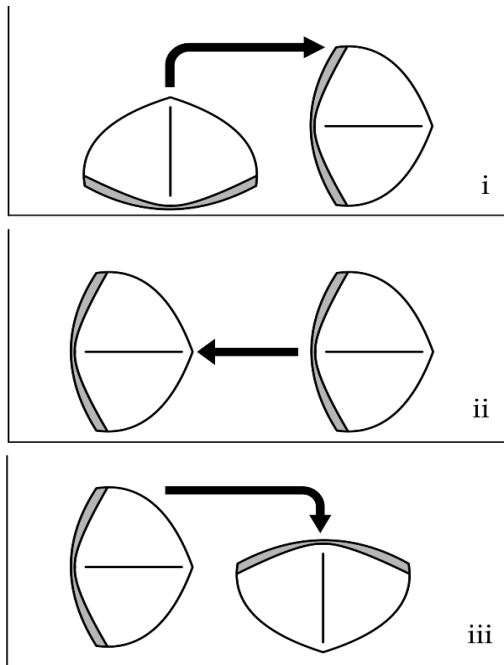
15. Flipping boats

Flipping a lelievlet is a relatively simple task, but it is also the most dangerous thing you will do during the winter season. It requires good coordination, lots of people and strong leadership. If a boat is placed on its side and then dropped, it can do serious damage to both people and property. A lelievlet is heavy enough to break every bone in your body if it falls on you. Select one person as the leader, to coordinate the entire flip. This person should not tolerate people goofing about or talking through them. Send them away to keep working safely. It is also advisable to flip with only Dutch-speaking people, to keep communication clear. To flip a boat safely, you will need at least ten (strong) people², but more is always better.

² To get more people, flipping is usually worth two participation points.

First, collect several old car tyres or wooden beams on which the boat can rest, so it never lies directly on the floor of the workshop. This protects the paintwork and prevents small parts like the shroud ring on the gunwale from bending. Also get a doormat or a blanket to put underneath the boat when you wiggle it.

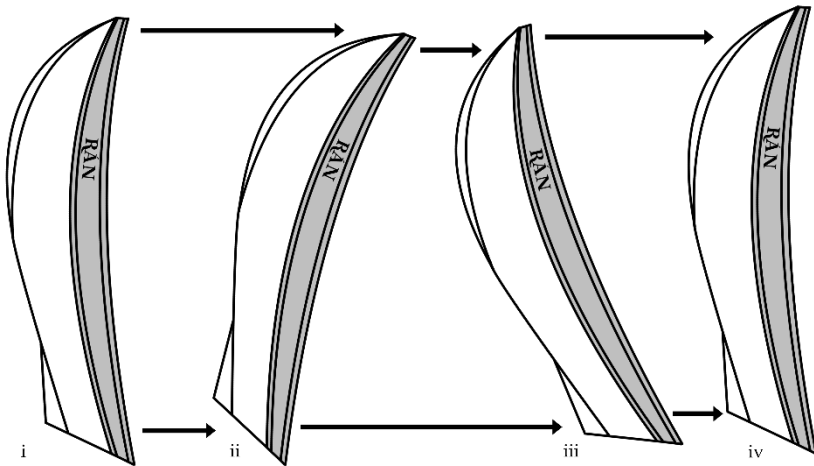
A flip is executed in three steps: lifting, wiggling and settling. Before you start with any of these, clear the space where you want to flip. Remove any items that people can trip over and push larger objects to the walls to create space to lay down the boat. To flip a boat without wiggling, you will need about three to four times the width of the boat in space. If you do not have that much free space, clear two boat widths to wiggle and flip.



The steps to flip a boat underside to upside. i: set the boat on her side, ii: wiggle the boat to create more space, iii: set the boat down, upside up

When ready, start with the first step and put the boat on her side. Have everyone except for one or two people stand at one side of the boat and slowly lift it. The other two people stay on the other side to guide the boat and keep it stable when the boat is placed on her side. Lift the boat in the direction you want to flip, this makes wiggling quicker and easier. Place the doormat or blanket underneath the gunwale where the boat will rest on the floor, usually just behind the ring where the shrouds are attached.

With the boat on its side, the next step is to wiggle the boat, if necessary, to create more space to flip. Choose two people to stay in the middle of the boat, one on either side, then have the rest move to either the front or the rear of the boat, *one at a time*. Make sure to do this slowly, so there are always enough hands on the boat to keep it steady. When everybody is in place, lift up the front and move it sideways, while the people at the rear hold the boat down. It is important to actually lift the boat up. If you just pull, you will pull over the boat rather than turn it. Next, do it in reverse: lift up the rear and move that sideways while pressing down at the front. Continue with lifting rear and front to move the boat sideways while upright and to create enough space to put the boat down. Always be extra careful when wiggling, because it carries the most risk of the boat falling over on someone. Check that people cannot fall or get stuck between the boat and the wall or some other object. Wiggle slowly and gently, and keep the boat as steady as you can.



The steps to wiggling a boat on its side (top view). i: Starting position, ii: move the front, keeping the rear in place, iii: move the rear keeping the front in place, iv: align the boat, ready for settling.

When the boat is in position to settle her on her new side, have everyone except two people move to the side of the boat on which you want to put it down. Place the tyres of beams on the floor where you expect the boat to land. Slowly lower the boat down, while the two people on the opposite side either stand on or hang on to the gunwale to act as a counterweight. Do not bother to much with putting the boat down in exactly the right spot right away. Warn everyone to be careful when they step backwards so they do not hit anything and to watch their fingers.

When the boat is put down, take a moment to stabilise her and move her to the final location. Push and pull on the boat to see if it moves and place more tyres or beams underneath the boat where there is slack. Make sure that the skag and forestay tang are either on a tyres or beam, or off the ground. Have some people lift either the front or the rear to move the boat or place more supports underneath it. When the boat is stable and can no

longer wiggle when pushed, you are done. Put the doormat back and remove any leftover tyres or beams.

16. Launching a boat

The waterscouting is responsible for pulling the fleet on shore at the start of the winter season; they usually get a crane to do this. Before they can pull up the fleet, the boats first have to be disassembled. The waterscouting also pressure washes the boats, so the worst of the dirt, filth and subaquatic organisms are removed. It is, however, our own responsibility to put the boat back into the water ourselves.

Before you can start moving the boat, you will most likely have to flip the boat first, so it is right side up. During flipping, when the boat is on its side, you have to put the centreboard in and tighten down the swivel bolt on the underside of the boat. Coordinate with someone on both sides of the boat to get the board in quickly and safely.

The waterscouting has a boat trailer suitable for lifting a boat and moving it towards the water. You can launch a boat near the canoe jetty, but with very high water, you can also launch a boat directly next to the main pier. Before you can use the trailer, make sure the steering jig is properly attached and tie a long rope to the front of the trailer, where about six to eight people can pull or slow down the trailer.

The trailer uses chains on a pulley system to lift the entire boat, so it can be easily moved around. Four chains with a hook have to be attached to the hoists of the boat. Two longer chains go towards the back, the shorter chains to the front. Attach each hook from underneath the hoists; that way they cannot get loose when under tension. Hoist the boat by pulling on the chainwheel attached to the side of the trailer. Use a strong rope to lash the

towing ring to the support bar on front of the trailer when the boat is far enough of the ground. This prevents the boat from swinging back and forth when going over bumps.

Pull the trailer of the field and have someone you trust steer the trailer. If you are guiding the trailer, it is best to stay at a distance, where you can keep a good overview of everything. Do not move the trailer too fast, so no-one can get stuck or their toes driven over in the event something goes wrong. Turn the trailer in front of the ramp you have decided to use and slowly reverse the trailer towards the water, using the long line on front the slow down the trailer. Put the trailer in the water beyond the wheels, untie the towing ring and lower the boat into the water. When the boat starts to float, you can have someone climb in, remove the hooks and scull the boat to the main pier. Bring an oar and two mooring lines along.

Lifting and moving a boat is always a dangerous undertaking, so make sure you have enough people to do it safely. Have everyone be quiet and listen to your instructions. You have to be strict when people start messing around; this distracts the others and can cause dangerous situations to occur. If people keep messing around, send them away. To make communication easier, it is advisable to only work with Dutch-speaking members (assuming you are a Dutch-speaker as well).

17. Marling

Marling is a Swedish-derived term for the way you tie the mainsail to the boom and gaff. This is not difficult to do, but since it is only necessary once a year, no many people know how to do it. Marling needs to be tight, so there can be no gap

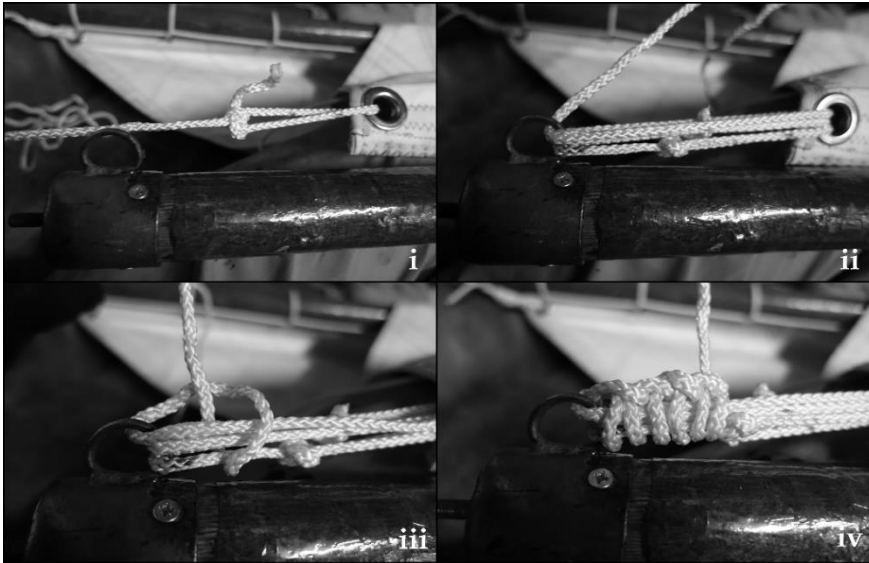
between the woodwork and the sail. If there are gaps, wind can blow through it and impede the speed of the boat.

For marling, you will need a good length of 6 mm white nylon cord. 25 metres is enough for marling the sail, spanning the sail and creating a mast lace. The cords need to be replaced every year, but keep old marling lines to make caplines, gunter block stoppers and laces for the sail cover. You can buy marling line at most hardware stores; look for the chains and ropes section.

17.1 Spanning the sail

The first step is to span the sail onto the boom and gaff, so that the sail is stretched along the woodwork. This makes it easier to marl the sail and ensure you have maximum sail surface.

Put a bowline through the eyelet in the end of the sail, then tie it with multiple loops to the end ring on the woodwork. Start with the side closest to the mast, so the gap between the mast and the sail is as small as possible. Tie the knot off with a series of half-hitches around the loops you have made. Do this on both ends, as tight as possible. The edge of the sail should be stretched just on top of the boom or gaff. Cut off the ends of the cord you used to span the sail and use a (gas) lighter to melt the ends, so they do not fray.

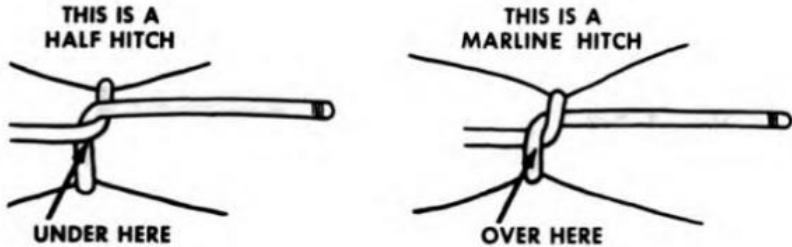


The four steps when spanning a sail. i: tie a bowline in the sail, ii: loop the line several times between the sail and end ring, iii: tie of the line with a half hitch, iv: continue tying half hitches until you run out of line.

17.2 Marling the sail

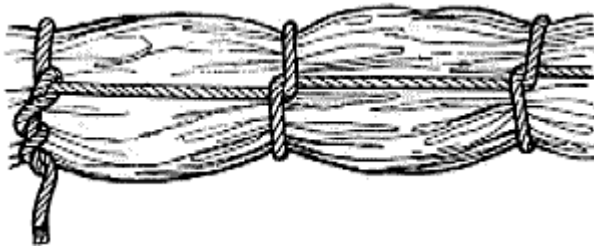
Measure out a length of cord that is two and a half times the length of the boom or gaff and add about 30 centimetres to it. At the eyelet on the woodwork closest to the mast, where you also put the spanner, put a bowline through the hole and you are ready to start marling. Always work from the mast to the stern, so the little stretch left in the sail will be pulled towards the back of the boat. Pull the cord through the next loop in line, away from you, then pull it from behind round the woodwork back towards the front. To make a stitch, pull the cord over the horizontal bit you just made, then pull it underneath from the top left to the bottom right. This direction is especially important.

If you make it this way, the stitch will tighten itself when pulled. If done wrong, the stitch will lose tension and allow gaps to form.



The difference between a half hitch and a correct marling hitch

Pull each stitch tight enough so the edge of the sail can stand upright, but there is no space between the sail and the edge. You should be just about able to put two fingers between the sail and wood. Keep tension on the chord with one hand and make the next stitch with your other hand. Keep going until you reach the end of the boom or gaff. Before you tie off the cord, check if all the stitches are neat and tight enough. Tie off the cord in the same way as you did with the spanner: make multiple loops between the last eyelet and the ring at the end of the woodwork. Finish the knot with a series of half stitches around the loops you made. Cut off the cord and melt the ends to prevent fraying.



A correct series of marling hitches along a furling sail

18. Splicing lines

All lines aboard a relievlet, apart from the sheets, are made from three-strand twisted rope. To make a line from this kind of rope, the ends need to be 'spliced', or woven, into specific shapes. This forms permanent loops and bulges in the rope, so they can easily be used as mooring lines, halyards and other purposes. It also prevents the line from unravelling even when used vigorously. When making lines, a good rule of fist is to always make them a little longer than you need. Lines can be shortened, but never made longer again.

Ropes used on modern boats are almost always made of synthetic materials like nylon. This is cheaper, stronger and better resistant against the elements than natural materials such as hemp or flax. Another advantage of synthetic ropes is that the fibres can be melted with a lighter and stuck together, so the strands cannot fray. Store rope and lines coiled in a plastic bag, or hang them up. Clean lines in warm water and dish soap to get rid of dirt and sand, which can scour and damage the fibres of the rope.

When buying new rope for lines, keep a few things in mind. The rope should be 10 or 12mm thick and have a breaking strength of at least 850kg. Mooring lines and anchor lines need to be stretchy, so they can take the strain of the waves. Rope for halyard so be very stiff and not stretch at all. For mooring lines and anchor lines, buy rope from a material that is water resistant and sinks. Rope for halyards should float and be UV-resistant instead. Lastly, buying an entire spool of rope, usually 220 metres, is almost always cheaper than buying per metre, but it takes some investment.

There are three kinds of splices commonly used on a boat: the end splice, eye splice and short splice. Each has its own purpose

but they are made with the same principles. To make a splice, you will need some tape, a (gas) lighter, a knife and optionally a special splicing needle, called a fid. A fid is used to create space between strands. For eye splices in halyards, you will also need loop rings.

Mooring lines should be ten metres long, with an end splice on one end and a large eye splice on the other, without a loop ring. Halyards should be at least thirteen metres long, with an end splice on one end and an eye splice with loop ring on the other. The loop ring protects the inside of the eye splice against friction from the hooks used to attach the sail. An anchor line should be twenty-five metres long, with an end splice and a eye splice with loop ring.

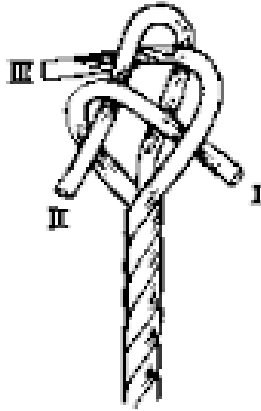
For extra explanation about splicing, as well as useful videos, see www.animatedknots.com.

18.1 End splice

The end splice is the easiest splice and is used at the end of lines. It create a thick bulge on the end which prevents the rope from fraying and from coming through pulleys.

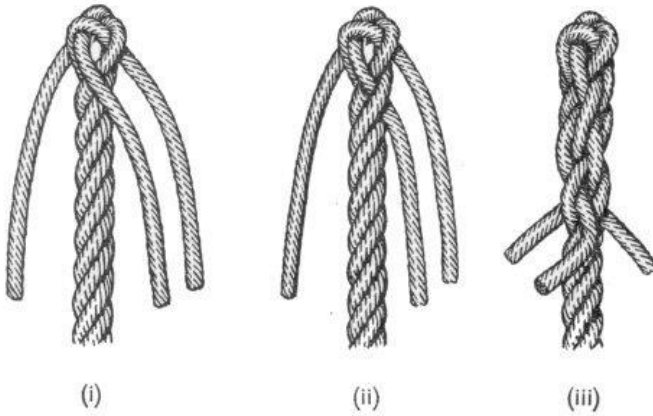
Before you cut your rope to length, wrap some tape around it to prevent the end from fraying right away. Use a sharp knife without teeth to cut the rope clean through, then melt the ends with the lighter to sticks the fibres together. This prevents them from fraying while you make your splice. Carefully take off the tape and split the rope into three strands. Put some tape on each strand and melt the ends together again. You should now have three separate strands, each with some tape and a molten end.

Untangle the rope for about ten to twelve centimetres. Put in a three-strand half hitch, called a crown knot, to start the splice.



The correct method for tying a crown knot on a three-strand rope.

Next twist the rope underneath the knot to slightly unravel the strands. Weave the three taped stands back through the rope, against the direction of the rope-strands. Pull a strand first underneath, then over a rope strand. Continue until you have woven in the tape-strands as far as possible. Roll the splice between your hands to settle the strands in a comfortable position. Take off the tape and cut the ends to length, about one centimetre from the body of the splice. Melt the end with the lighter to prevent them from fraying.



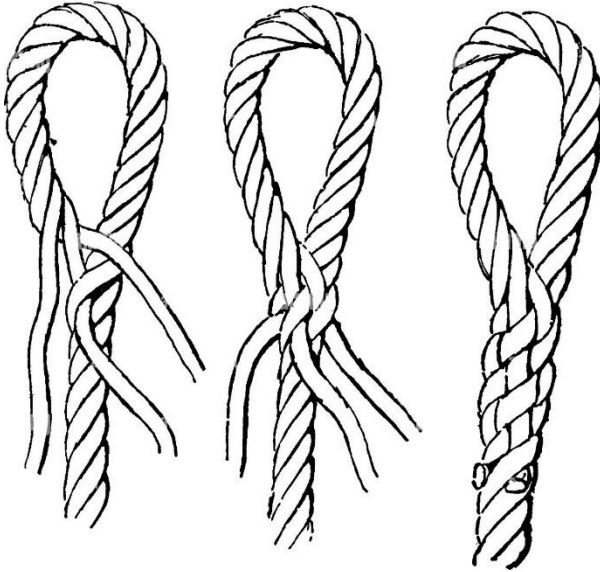
The steps for making an end splice. i: crown knot tied in place; ii: first strand braided back into the rope; iii: finished end splice

18.2 Eye splice

The eye splice uses the same weaving technique as the end splice, but the end of the rope is woven back into itself in another place to form a loop. This splice is more difficult, as it can be tricky to align each strand with a companion.

Start the splice in the same way as the end splice, by taping, cutting and melting the rope to length. Untangle the rope for about ten to twelve centimetres. Bend the rope and place the untangled end back on the rope to form a loop. If you are making a halyard, place the loop ring in the loop and bend the rope as tightly as possible around the ring. For mooring lines, make the loop larger, with a diameter of about ten centimetres.

Twist the rope to create gaps between the strand and weave each taped strand through the gaps. Form the loop into the correct shape before you continue weaving. If the loop is formed, the rest of the weaving goes exactly like the end splice. Pull the tape-strands over and under the rope-strands until you finish the body of the splice. Cut the strands to length and melt the ends.

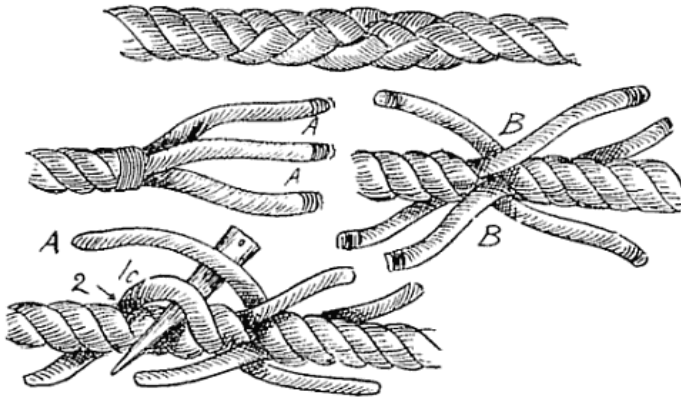


The steps to make an eye splice without loop ring. The alignment of the strands in step one is crucial for a strong eye splice.

18.3 Short splice

The short splice is used to weave together two ends of a line to make it one long line again. This is useful for repairing broken lines or when you cut out a bit of a line that has been damaged. The splice does create a bulge in line, meaning it might not pass through a pulley anymore.

Start a short splice by preparing both ends in the same way as the end splice. Tape, cut and melt each strand of both ends, but do not put a crown knot in. Put the untangled ends against each other and weave the tape-strands from one line through the rope-strands of the other line. This splice is tricky to start, as pulling one strand will place another out of alignment. After putting in



The steps for making a short splice. The fourth image shows the use of a fid to open the strands.

the first weaves on both ends, take a moment to tighten and straighten all the strands before continuing. If you don't, the splice might not be straight or become thicker than intended. Work on both sides at the same time, to keep the body of the splice straight and tidy.

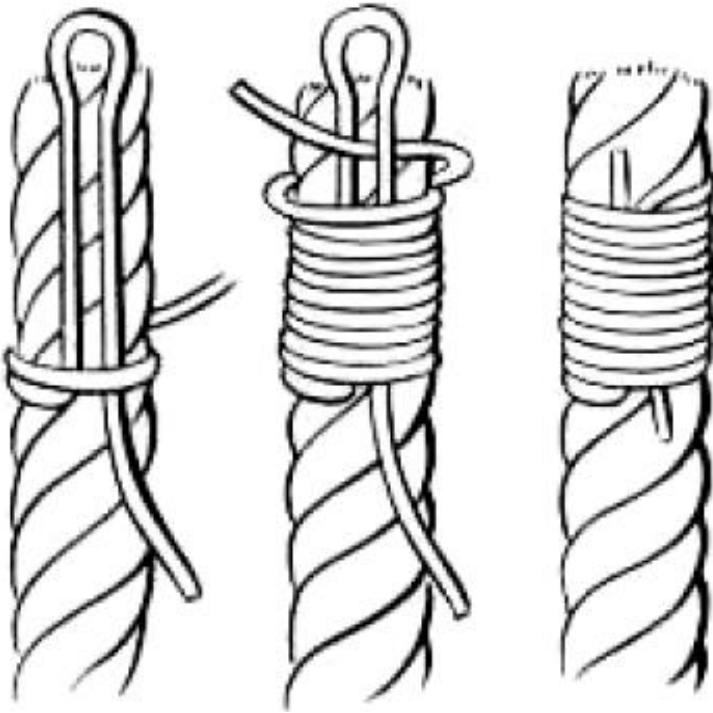
18.4 Whipping knot

The whipping knot is not a splice, but a knot designed to tie the strand of a rope together, to prevent the rope coming undone. This method is more difficult than a splice, but it does not make the rope thicker. Lines with a whipping knot can therefore still pass through pulleys. Braided rope cannot be spliced and have to

be finished with a whipping knot. On a lelievlet, only the sheets are made from braided rope.

To make a whipping knot, you need some strong cotton thread. Sewing thread is too thin and fragile to make effective whipping knot, even the extra strong variants. Most nautical stores and rope stores have whipping thread in stock, in different colours and thicknesses.

To make a whipping knot, cut a generous amount of string from the spool. Make a loop in one end and lay this loop on the end of the rope, with the end of the thread facing away from the end of the rope. Tightly wrap the rest of the thread around the rope, over the loop, until the loop is almost entirely covered. Pass the end of the thread through the loop and pull both ends tight to complete the knop. Tie the ends of the thread together on top of the whipping knot, so the knot cannot unravel by itself. Cut the ends of the thread to finish the whip. A whipping knot has to be made neatly and be very tight, otherwise it does not work. This takes some practice to get right, but a well-made whipping knot will stay taut for years.



The steps to tie a whipping knot on the end of a three-strand rope. The final knot to tie the ends together is not shown.

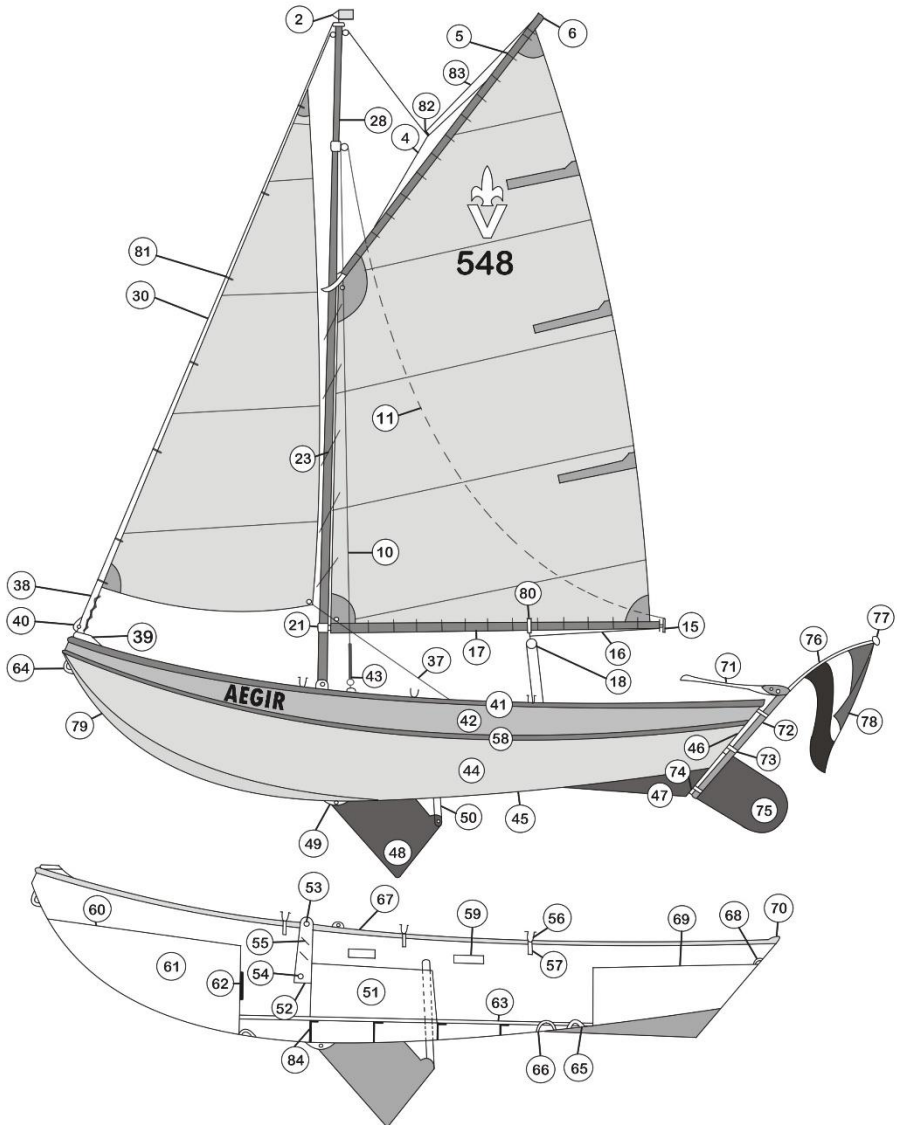
Appendix A: Overview of paints and varnish

The table below holds an overview of all the different kinds of paint and varnish used for boat maintenance. All paint cans have the year they were bought written on them, try to use older paint first before opening newer cans.

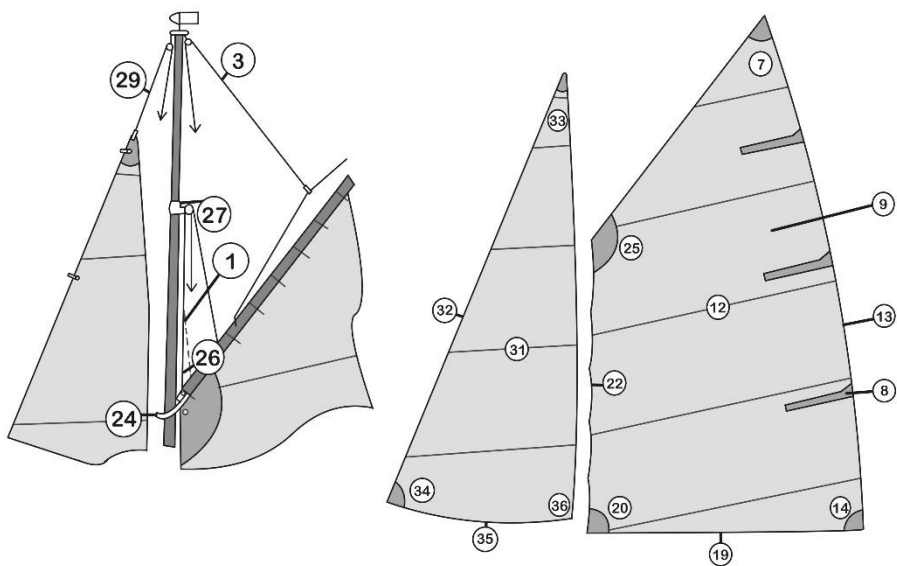
If you have any question about the paints or what you should use, contact Jasper Jonk, the person in charge of paint supply, via +316 12 88 91 90.

Code/name	Colour	Usage
Interturf 203 Aluminium	Silver	Primer for paint and tar
Interturf 16 Black	Black	Tar for bottom, rudder and centreboard
Interlac RAL 5003	Blue	Paint for chine, decks and lettering
Interturf 262	White	Base layer for gunwale, after primer
Hoogglans Lakverf voor buiten	'Reddingsvest'	Custom mixed orange paint for the gunwale
Interlac 678 Vernis	Clear/slightly purple	Varnish for all woodwork

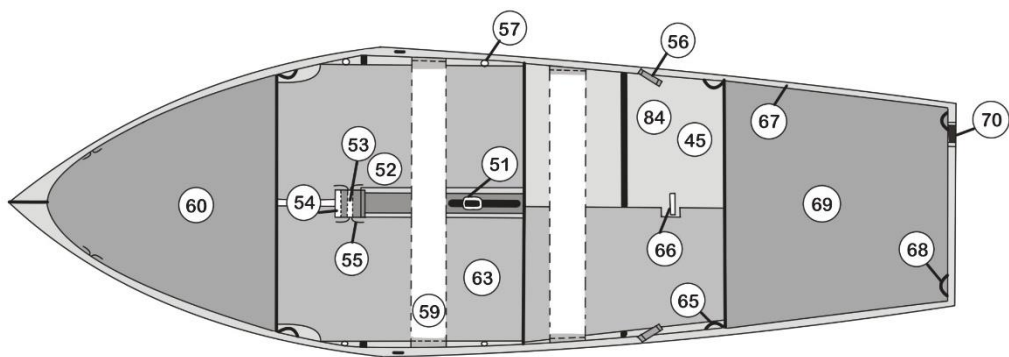
Appendix B: Overview of parts



Side views with attached rigging and intersection diagram



Overview of the rigging and sails



Top view of the casco

1	Throat halyard	29	Job halyard	57	Rowlock socket
2	Wind vane	30	Forestay	58	Strake
3	Peak halyard	31	Jib	59	Thwart
4	Gunter	32	Luff (jib)	60	Foredeck
5	Boom lace (gaff)	33	Head (jib)	61	Air compartment
6	Gaff	34	Tack (jib)	62	Manhole
7	Peak	35	Foot (jib)	63	Decking boards
8	Sail batten	36	Clew (jib)	64	Towing ring
9	cloth	37	Jib sheet	65	Hoists
10	Shroud	38	Jib chain	66	Main sheet ring
11	Topping lift	39	Forestay tang	67	Jib sheet rings
12	Mainsail	40	Forestay tightener	68	Mooring line rings
13	Leech (main)	41	Gunwale	69	Quarterdeck
14	Clew (main)	42	Gunwale	70	Sculling lock
15	Swivel	43	Shroud Tightener	71	Tiller
16	Capline	44	Chine	72	Rudderstock
17	Boom	45	Bilge	73	Pintle
18	Main sheet	46	Stern	74	Gudgeons
19	Foot (main)	47	Skeg	75	Rudder blade
20	Tack (main)	48	Centreboard	76	Flagpole
21	Gooseneck & goosepin	49	Pivot pin	77	Finial
22	Luff (main)	50	Board handle	78	Flagpole
23	Mast Lace	51	Centreboard box	79	Bow
24	Gaff jaws	52	Tabernacle	80	Sheet ring
25	Throat	53	Mast bolt	81	Jib hank
26	Gaff noose	54	Latch bolt	82	Gunter block
27	Mast ring	55	Cleat	83	Gunter block stopper
28	Mast	56	Rowlock	84	Frame

Appendix C: technical inspection checklist

The waterscouting uses this checklist during the annual inspection at the start of the summer season. It lists all the aspects and parts of a boat that must be in good order before it may be used in sailing. Every item on the list has to be checked for a) presence and b) condition.

The list is categorised into three groups, based on necessity. Group A are the parts that are essential and have to be in good order. Group B are parts that are non-essential but very useful and heartily advised to have. In group C are items that are non-essential and useful on board, but without them, a vlet can still be sailed safely.

At Aqua, we try to get as many things checked of the list as possible, including those in groups B and C, but we use the priorities listed above when decided what to focus on.

deel A - i.v.m. veiligheid en B.P.R. noodzakelijk.

deel B - suppletie lijst van onderdelen, waarvan aanwezigheid ten zeerste wordt aanbevolen.

deel C - lijst van onderdelen, waarvan het gemakkelijk is, als ze aan boord zijn.

NAAM VAN DE BOOT

NR.

GROEP:

V = goed

O = voldoende

- = slecht of niet aanwezig (zie opmerkingen)

DEEL A	40 KETTING VOOR DE FOK	
01 CASCO ALGEMEEN	41 SPANTEN	
02 LUCHTKASTEN	42 BUIKDENNING	
03 NAAM VAN DE BOOT	43 DOFTSTEUNEN	
04 LANDVASTOGEN	44 DOFTEN	
05 LANDVASTEN	45 ROER MET BORGING	
06 SLEEOGEN	46 ROERHAKEN	
07 BEVESTIGING MASTKOKER	47 VINGERLINGEN	
08 KIKKERS	48 HELMSTOK	
09 MASTBOUT 0 10 mm	49 DOLPOTTEN	
10 MASTGRENDELBOUW 0 8 mm	50 DOLLEN MET KETTING 6x	
11 ZWAARDKAST EN -BOUW	51 RIEMEN 6x	
12 ZWAARDLOPER EN -PLAAT		
13 BORGPEN 0 6 mm, KETTING	DEEL B	
14 MAST	01 WRIKRIEM	
15 MASTBAND	02 ANKER	
16 TOPMASTBAND	03 ANKERKETTING	
17 VOORSTAG	04 ANKERLIJN	
18 VOORSTAGKLEP	05 DODEMANSLIJNTJE	
19 HANEKAM	06 MIK	
20 ZIJSTAGEN	07 BOOTKIST	
21 SPANNERS / KETTING	08 HOOSVAT	
22 WANTOGEN, PUTTING	09 GEREEDSCHAP	
23 HARPEN	10 MEERPEN	
24 GAFFEL MET DRAAD	11 MISTHOORN	
25 GIEK	12 E.H.B.O. DOOS	
26 LUMMELBESLAG	13 REDDINGBOEI, -KLOS	
27 WERVEL		
28 GROOTZEIL	DEEL C	
29 NOKVAL, PIEKEVAL	01 STOOTWILLEN	
30 KLAUWVAL	02 WAARLOOS, RESERVEMIDDELEN	
31 GROOTZEILSCHOOT	03 WAKERTJE, WINDVAANTJE	
32 SCHOOTRING	04 KRAANLIJN	
33 BLOKKEN	05 ZEILBANDJES	
34 MARLLIJNEN	06 ZEILKLEED, HUIK	
35 RIJGLIJN	07 DWEL	
36 UIITHAALEINDEN	08 HAAKSTOK	
37 FOK	09 VLAGGESTOK / GEUS	
38 FOKKEVAL	10 HIJSGOEN	
39 FOKKESCHOOT	11 PETTENLIJNTJE	

DATUM: _____ CONCLUSIE: GOED / NIET GOED

Opmerkingen A. repareren _____

B. aanschaffen _____

Handtekening: _____ van technische dienst _____ voor akkoord betr. leiding: _____

NAAM in _____

blokletters: _____