



Upffront.com Winch Selection

Introduction to manual winches & winch handles

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1. Introduction – what are my options?

With marine manufacturers offering an ever-wider selection of winches for your boat, making a choice can be a daunting. The main consideration may be the winch size (Power Ratio), but there are also Style, Speeds, Material and Grip to consider. That’s without going into powered options, and then an extensive range of winch handle styles and sizes!

There’s no argument that choosing a winch size that is too small for the job is a waste of money, and there will be the temptation to err on the side of caution. However, winches are an expensive bit of kit and simply over-sizing can also lead to problems of overloading other rigging and deck equipment. So, it is an important consideration and an educated choice will save you from unnecessary spend.

2. Leverage, Gearing and Power

The mathematical bit! The simplest winch design is a one-speed, non-g geared winch. The winch drum revolves once for each revolution of the handle. **Leverage** is generated by the larger radius of the turning circle of the handle compared with the radius of the winch drum.

A 254mm winch handle turning a 60mm radius drum will generate a **power** ratio of $254 / (60) : 1$

2 Which multiplies the sailor's pulling power by a factor of 8.5.

N.B. in practice, some of this theoretical power will be lost to friction in the handle and internal winch mechanism.

Geared winches increase the power ratio by increasing the number of handle turns needed to turn the winch drum. A 3:1 gear will increase the pulling power on a line by a factor of 3 compared with a non-geared winch. However, it is important to note that the line will be pulled in 3 times slower!

A 254mm winch handle turning a 60mm radius 3:1 geared drum will generate a theoretical power ratio of:

$$3 * \frac{254}{\left(\frac{60}{2}\right)} : 1 \quad \text{which equals} \quad 25.4 : 1$$

In general, the power ratio is calculated as

$$\frac{G * H}{D} : 1 \quad \text{Where G = Gear ratio, H = Handle length and D = Drum diameter.}$$

Manufacturers generally name their winches according to the approximate power ratio generated by the highest, most powerful gear, assuming a 254mm winch handle.

For example, take the Harken 40. It has a drum diameter of 80mm and a gear ratio of 6.28 in its highest, most powerful, second gear.

$$\text{Using the equation: } \frac{G * H}{D} : 1 \quad \text{where G= 6.28, H = 254 and D = 80}$$

We get a Power ratio of 39.9 : 1 => Harken 40.

The Andersen 40 by comparison, has a Drum diameter of 75mm and second gear ratio of 6 which achieves the same overall Power ratio as the wider Harken 40 drum.

Yes, but now what?

So now we understand how the winch sizes are derived, how to choose the right one for the job? A common piece of advice handed out is to "go with the biggest you can afford". Aside from being a waste of money, there is the potential for overloading other deck gear, so getting the correct size is important. Your winch needs to be big enough to do the job, but not too big.

Fortunately, each winch manufacturer provides some sort of sizing guide, meaning you don't have to calculate the power required to haul the sail, estimate the pulling power and work out the ratio required. Unfortunately, the criteria used vary widely between manufacturers, making comparisons between brands difficult. Some use solely boat length whilst others use estimated sail sizes plus boat and/or rig specifications.

Knowing how the names are derived, one would suspect that for a given sail size on a similar length boat one would need a similar max power ratio and therefore the manufacturer recommendations would be the same? Following on with our Harken/Andersen 40 example: see the recommendations from four different manufacturers for genoa, main and spinnaker sheet winches below:

Manufacturer Recommendations	Genoa Sheet	Mainsheet	Spinnaker sheet
	Max sail area (m ²)	Max sail area (m ²)	Max sail area (m ²)
<i>Harken 40</i>	25	38	115
<i>Andersen 40</i>	44	43	150
<i>Lewmar 40</i>	44	28	74
<i>Antal 40</i>	40	57	105
<i>Overall % difference</i>	76%	103%	103%

So, what do these quite significant differences in manufacturer recommendations tell us about winch specification?

Answer: It is a relatively subjective decision!?

The differences here between Harken and Andersen probably reflect their different attitudes to performance and what power is required to “effectively” pull in a 25m² genoa. With a more raceorientated background, Harken recommend more power for an equivalent sized sail compared to Andersen whose clients are more cruising orientated. This makes sense.

However, some of the differences are down to how each manufacturer has generalised between masthead vs fractional rigs, assumed purchase ratio on the mainsheet and averaged I, J, P and E rig data. There are also significant differences in loads on halyards and sheets for heavy cruising boats vs. light displacement race boats, mono-hulls and multihulls and it is very difficult to generalise.

Therefore, the key take-away here is that these are **only guides** and your final decision should come down to consideration of your boat type, your own sailing style and the capabilities of your crew. If you have a relatively standard performance mono-hull and the plan is to gently potter, reverting to the engine when increased winds make the going tough, you may be able to go to the smaller end of

the recommended ranges. However, if you are a racer or the hardy type that will reef down and carry on regardless, then you should look towards the larger end of the recommended ranges. Similarly, with your crew – consider the abilities of the people you will be sailing with, not just yourself. And if you intend these winches to last long into your retirement years, bear in mind that your pulling power may decrease and a larger winch size will help “future-proof” your boat!

3. Single and Multiple-Speeds

Single-speed winches can be either geared or non-geared. They pull in the rope when turned in one direction and ratchet when turned in the opposite direction. This means you can operate it, at higher loads, with a pull-push-pull action which can be less tiring than turning complete 360° turns.

Multiple-speed winches have different gearing depending on the direction of rotation of the handle. The first speed may be either “direct drive” (non-geared) or geared. A typical combination of gears on a two-speed winch is 2.13 & 5.65, resulting in power ratios of 13.5 & 35.9. But remember that although this top gear in theory multiplies your input force by a factor of almost 36, it also reduces the speed at which the rope comes in by the same factor.

Three-speed winches offer a third gear by switching the direction of rotation of the handle back to that of the lowest speed, normally by engaging a button for the first gear. Thus the progression of gears might be:

- Clockwise: 2.2
- Anti-clockwise: 4.8
- Clockwise: 14.4

Once your preferred size of the winch has been established (see section 2, above), consideration should be given to the range of loads that the rope will exert and the speed at which it is required to be hauled. A genoa sheet that initially needs to be wound in quickly, but which then sees very high loads will benefit from a 3-speed winch with a non-geared highest speed. A 3-speed winch can also be useful when one winch is required to multi-task across a variety of lines, efficiently covering a range of power sizes.

When speed is less imperative, and maybe pulling strength a little lower (for example when cruising), a two-speed winch with higher gearing may be more appropriate.

4. Plain-top, Self-tailing and Top-cleating

Self-tailing winches are ideal for shorthanded sailing and free up a hand for increased power on the winch handle. It is particularly important with self-tailing winches that you check the max/min line size specifications for the winch; too small a rope and the jaw will not grip well; too large and the jaw may damage the rope.



Plain-top winches are less common on larger boats and are more usually seen on small racers where lines are constantly being trimmed, or where quick release of the line is imperative.

Some larger, racing orientated winches offer a top-cleat (instead of a self-tailer) that rotates with the winch. They are a fast, tidy way to secure lines. The absence of a self-tailing arm can make for a quicker, safer cast-off and still allow some fine-tuning without releasing the line from the cleat. Top cleats are typically used for primaries but don't offer sufficient security for holding halyards.

5. Material

The most cost-effective winch material is **anodised alloy or aluminium**, which gives a light, relatively resistant finish. **Stainless steel** offers a more durable finish with about a 30-50% weight gain over aluminium, but is also the most expensive option. A **chromed** finish (usually on a bronze base) gives an attractive, durable finish, but is in the region of 40-60% heavier than aluminium (depending on whether the whole winch is chromed or just the drum). **Bronze** finishes are usually only seen on traditional yachts. They enhance the look of a classic yacht but require frequent polishing and can be over 60% heavier than aluminium. Carbon fibre winches are the lightest option for high-spec racing yachts, offering a weight saving, over aluminium, in the region of 15%, but come with a high price tag!

6. Grip

Another important aspect to consider is the type of grip on the winch drum. This will either be shape friction (where the grip comes from the shape of the drum i.e. from the addition of ridges/facets) or surface friction (where the surface is roughened). The ridge/shape derived grip is kinder to your ropes, but a surface grip will be more effective on high tensile strength, small diameter racing sheets. A surface grip will deteriorate over time and can be costly to re-surface. In the case of the Harken Radial winches, the grip ridges are also shaped to drive the rope towards the bottom of the drum when easing, which helps prevent riding turns.

Examples of Surface Grip winches:



Examples of shape friction winches:



- Orientation of the drum and self-tailing arm are critical ○ Refer to specific manufacturer recommendations
- Check, and modify if necessary, rope lead angles onto the drum

8. Powered winches

Powered winches, particularly electric, are increasingly popular. This is probably due to the increased availability of cost effective power on-board. The other powered option is a hydraulic winch which is normally limited to larger boats (80ft+) with other hydraulic systems on-board. Either variety can be “power-in” only, or “power-in/power-out”. Powerout winches allow the rope to be eased without removing the line from the self-tailer.

Special consideration needs to be given to the amount of space available to house the motor and to the amps, or pressure that the winch will draw from the boat’s existing systems.

Powered winches is a complete subject in its own right and will be covered, in detail, in a future guide.

9. Winch handles

The main decision to make regarding winch handles is the length. A 254mm (10”) handle will have a 25% power advantage over a 203mm (8”) handle, but the larger turning circle can be tiring for those of a smaller frame and takes longer to complete a full turn. If space is restricted, a shorter handle may make the difference between being able to carry out a full 360° turn or not.

Important Note: Remember, if you use a smaller winch handle – consider the changes to your effective power ratios and the required winch size. All manufacturer winch specifications are based on a 254mm handle.

Other winch handle variants include:

Lock - The handle cannot be accidentally knocked out of the winch without releasing a locking switch. Not only can this prevent handles being lost overboard as they are flipped out by a flogging line, but it can also prevent accidents if a handle slips out of its winch during grinding. There are a variety of locking systems on the market. The most common being a spring-loaded knob/lever on the top of the handle, at the centre of the winch, which normally requires two hands to engage/release. Increasingly popular are more advanced mechanisms, located along the shaft of the handle, which can be operated with just one hand.



Grip - Full double grip handles have two free-rotating hand grips allowing for comfortable, powerful two-handed use, but these are big and cumbersome and there is a move towards modified versions which are really a 1.5 grip. Low-profile/Palm grip handles allow fast cranking using just the palm of the hand when loads are low with enough room for a twohanded grip for higher loads.



Material - Aluminium handles are standard, but bronze, chrome and steel are available to complement winches of the same finish.

Summary

Your winches are one of the essential performance factors on-board your sailing boat and so you need to ensure you have the right winch for the job.

You first need to be clear about the multiple different uses of each winch and size for the largest load. You also need to assess your sailing style, crew capabilities and space limitations and factor those considerations into your selection process.

The choice of material, based on sailing style, budget and personal preference, will quickly refine your options.

The choice of drum grip, between shape or friction, is also relatively simple. Drums that use friction grip are for high performance programs where you accept the costs associated with increased wear on your ropes and the drum itself. Shape derived friction is kinder on your ropes and the winch can be expected to last longer

Finally, selecting the correct power is essential but not easy. Manufacturers “guides” are just that – generic estimates - and it is **advisable to contact an expert**, once you have made your preliminary selection, for confirmation of the correct size for your specific boat, application and needs.

You have further questions.....?

If you have any questions regarding your winches or would like some recommendations on the right winches for your boat, please feel free to contact us by clicking the link below or by pasting the following link into your browser.

<http://info.upffront.com/winch-enquiry>.

Winch Enquiry