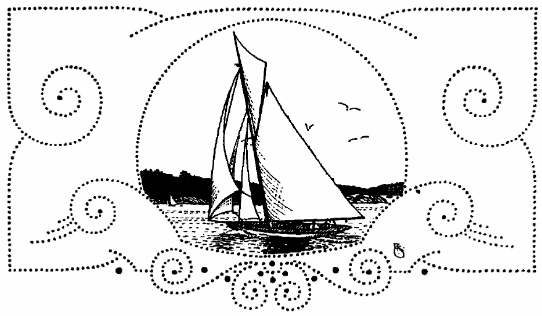

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Nynäshamn Olympic Jubilee regatta 1912 – 2012
Classic Boat Meet

The Alma rule of racing

General about handicap rules

Since the birth of mankind boats have raced against each other. Since boats are different, a number of rating rules and handicaps were developed, to enable them to race against each other. It should be the sailing ability of the crew, which was determining who won, and not the properties of the boat. The linear-rating system was created in England. Also the tonnage rule was developed, while in Sweden and the Nordic countries the cube rule saw light, as also the Benson rule. Soon after, we had the Universal rule in the US and the International rule on this side of the Atlantic. In due course we also had the RORC, IOR and recently the IMS and IRC systems. All tries to give a boat a number, describing the boat’s potential speed in different conditions in relation to others.

Immediately when a new rule has been introduced the designers have tried to cheat the rule, so that the new boat get a low rating while in reality the boat is faster than this rating. All these rating rules utilizes a number of measures of the boat’s hull and rig and via some mathematical calculation creating the speed potential of the boat, expressed as either a number or a set of numbers.

Another type of rating gives the boat a rating based on previous results. This type of Yard Stick (LYS) ratings are very good and have been used extensively up in Scandinavia for many years. Almost all amateur level club races are raced according to this. Unfortunately it does not function very well for a one–off boat never raced before.

One can also conclude that so far, no one has succeeded to describe the speed potential of a boat perfect. Even in the age of advanced computers, no one can exactly calculate how fast a boat sails in different conditions. We cannot describe the fluid dynamics over the hull, over the sails and the rig, with all its dynamic components. Actually this is fantastic. Still today with the enormous resources of modern computational fluid dynamics, we can’t do that.

There is something in a sailing boat that a computer cannot describe. This might be what in other areas is called art. Beauty perhaps, or the feeling.

Nowadays when classic yachts are raced either some derivative of the IMS system (or the ORC Club) or a leading yard stick rating are used in Scandinavia. In Germany Denmark and Norway a Calculated rating according to the KLR is used, or in the Mediterranean the CIM rule is used. More of this below.

Sweden

In Sweden we have used the LYS system and differing variants thereof, to be able to race different boats against each other. The Skerry cruiser association (SSKF) has their SSKF rating, which takes into consideration the individual boats status and condition, that they are built according to different variants of the Skerry Cruiser Rule (Different years), and actually also the ability of the skipper. A bit like the golf handicap system. Gaff Yach Society have had a similar system, which has tried to include also the boats who are a little unique, such as several gaff rigged boats and strange and very old boats. All have been given a rating number which one could relate also to the official LYS system. The last two years the Swedish Sailing Association SSF has introduced a number called SRS. This is based on a calculation, but also on previous results from a multitude of races.

This number and previously the LYS number is used in almost every club race in our country. The number is given in a list of all standard boats which has a reasonable result bank, over a number of years. Thus, it gives a number telling us how fast such a boat is in average, in different conditions and everything else influencing the result in a race. The database, which is huge today, is administered by the SSF.

The problem appears, of course, if this base of experience does not exist. If the boat is a one-off, or different from other boats in the data base, there is nothing to give an experience based rating number. Something else must be used. Both the SRS system and the ORC club system uses a basic calculation and then a comparison to other similar boats are made. The problem here is that the calculation and the data bank are secret. Another problem is that very different boats cannot be rated in a single calculation. One such property is obvious, as a planing boat. A modern sailing boat planes, but a classic boat, (except the old finned keeled flat raters) does not. If only boats sailing on their displacement are considered it is possible to reasonably well predict a boats speed potential. If the boat also is built already, there is no risk that someone will cheat such a calculation, which makes the task easier.

The principles of the KLR, CIM and Alma rules of rating

There are a number of parameters which roughly determines the properties of a boat. One such is of course the water line length. Everyone sailing knows that there is a certain speed that the boat cannot exceed, unless it is planing. We call that the hull-speed. This is equal to the square root of the water line length times 2.43 using metric measures. (Actually this describes the speed for the hull so that the Froude number is less than about 0.45) This is the speed reached when the bow wave coincides with the transom wave.

If this number is calculated for a number of boats one will realize that it does not fit very well with the real LYS number. There are more parameters influencing obviously. One such is the displacement, and another is the sail area. If you read the German magazine Die Yacht, you will always find that they give a number, which is the square root of the sail area divided with the cube root of the displacement. This number is a dimensionless figure, which describes the acceleration ability of the boat. The driving force divided with the mass.

Another factor can be the displacement divided with the length of the boat, which should describes the fatness, if the hull is stubby or long and sleek. A typical cruiser compared to a skerry cruiser with the same sail area. The friction of the hull against the water is another factor, which dominates the hull resistance at low speeds. This is proportional to the wetted area. (Most boat owners try to sieve the hull to make it smooth and slippery) The wetted area is much smaller for a fin keeled boat, than for a full keeled one, and thus a fin keeled boat of the same displacement and with the same sail area is the faster one. And the friction is also proportional to the displacement for similarly shaped boats. The hull friction at max speed however, does not dominate the hull resistance forces. In this situation it only constitutes about 35% of the total forces. The remaining mainly has to do with the induced resistance, i.e. actually how large waves the boat produces. A meter boat (Int 6mR, 8mR or 12 mR) is slower than a skerrycruiser with similar dimensions, since the latter only creates about a third of the wave height at max speed in comparison.

There exist a multitude of such relationships, which limits or enhance the speed potential of a boat. I warmly recommend my professor colleague at Chalmers University; Lars Larsson, who has written a book together with the boat designer Rolf Magnusson on this subject: The Principles of Yacht Design. It is a bible in this area.

The Alma Rule

The German classic yacht club Freundeskreis Klassische Yachten has developed a pragmatic calculation formula, which takes into consideration most of the factors described above. It has been used successfully for many years in their regattas. The Norwegian Club KTK (Klassisk Tresegler Klub) has also used it for a long time. In their home page you can find all their known yachts and their measures and the rating number. In Denmark it is in use as well, in the Sönderborg regatta for example.

When the Swedish Classic Yacht Union arranged a Classic Yacht Event in 2005 we realized that it would be very difficult to create LYS numbers for all boats participating. Actually about 75 boats which had announced their participation were unknown to us, regarding their sailing abilities. We then decided to use the KLR rule, but adjust it a little to suit our situation up here in Scandinavia. Among other things we would like to stimulate older boats to participate, since we have many of them. We also liked to adjust a bit so that gaff rigged boats were a bit better described and could have a chance. The adjustments made to the KLR rule are minor, and thus the Alma rule can be considered the same as the KLR rule.

The factors we would like to take a bit more in consideration are actually considered by the CIM (Committée International de Mediteerrain) which organizes classic boat races in the Mediterranean. They have designed an extremely complicated rule, which actually is based on the same principles but with a multitude of strange factors involved. It is so crazy in some respects that they have a certain committee, which has to interpret the rule and decide from case to case how to judge. But they do have some interesting factors included, which one can steal. One such is an age factor, which we stole. Further, they have a compensating factor for different keel forms which seems very good, and a compensation for different rigs and sails which is not so good. A small gaff rigged clipper stemmed cutter from 1895 actually does not have an equally effective rig as a SK22 even with the same sail area, for example.

The base for the Alma rule is an equation (which is similar to the KLR) which can be disseminated a bit:

$$Alma = 6 * \{(L^{1/2}/B^{1/2}) + 5 * (T^{1/2}/L^{1/2}) + (Sc^{1/2}/Dc^{1/3})\} * [2,43 * Lvl^{1/2}]^{1/2} + Spf$$

(In this equation I have used potential expressions instead of the usual root signs, which my Word version does not have)

Alma will be a number, which can be considered similar to a LYS number. It is expressed in percent instead. My own old Skerrycruiser Britt Marie will get a rating of close to 139, while it should have a SRS (or LYS) number of 1.16 (without spinnaker). To get the corrected time the sailed time is multiplied with the Alma number and the shortest time has won. If the Alma number is divided with 120, the SRS or the LYS number will be the result.

To define the different factors included, see definitions below.

The second last term in the equation above can be recognized as the hull speed as discussed before. The hull speed is thus modified with several other terms. The first term, length divided with width, describes the ”stubbyness”. The longer and sleeker, the boat will be faster. The second term describes the depth of the boat divided with the length. The deeper the keel the better it goes without adrift. (Remember that the keel form is introduced and compensated for later). The third term in the equation is the driving force divided with the mass to be driven. The more sails the boat has, the faster it is, and the heavier the boat is the clumsier and slower to accelerate it is.

Thereby the basic form of the calculation has been described. Thus, it actually calculate the speed of the boat, which is possible, but it also gives some speed inducing and speed reducing factors, also when the boat is not at full hull-speed.

What differs the KLR and the Alma calculation is that we have introduced some modifications to the sail area and to the displacement. Base is of course the real area and the real displacement, but modification terms are introduced. The sail area is modified depending on the rig form. The aspect ratio for the rig is calculated and the efficiency for different aspect ratios is given from a scientifically measured diagram. This gives a small but noticeable difference for a gaff rig with a low aspect ratio and a high effective slop rig, even if they have the same area.

The adjusted displacement has a factor, which increases or decreases it, depending on the Keel form. Also the age of the boat is included in this modification. A fin keel is more effective than a full keel, and the keel factor decrease the displacement for an effective keel (Gives a slightly higher Alma number). Also, the older the boat, the lower the displacement through the Age factor. The alterations are smaller than a few percent each, but it gives an old boat a small advantage. A vast majority of the boats however are about neutral and has no alteration at all, since the full keel as on a Skerry Cruiser or on a German Seefartskreuzer, or a S&S yawl from the 50’ies has the Keel Factor 1.00.

The last factor (Spf) is just a spinnaker factor. This is added to take into consideration if one wishes to sail with a spinnaker or a gennaker or without any of them. It is chosen to be constant 3, to stimulate the use of a downwind sail. Since the Alma number will be about 120 to 150, the factor is less than 3%, and less the larger the boat is.

In this way the speed potential is calculated for the boat. Is it absolutely fair? No probably not, but it is based on scientific facts and it is well proven in many countries over many years.

It is however fair in the sense that it is the measures of the boat, which is base for the number. It is also compared to the known SRS, LYS and ORC club numbers for about 50 boats. The difference is less than 2% for almost all boats. There are however two boats, which seems to fall outside this span. One is the “SK 95 Sport” Britt Marie, which we know very well and she get a very high calculated rating, due to a high, very efficient modern rig and a fin keel on a boat almost 21 meter long and very sleek. The other is a modern GRP winged keel 6mR of the last generation, which gets a very low rating. The R6 has a shallow keel and is very short with an extremely short waterline length, thus get a low rating. Both these and similar boats have to become adjusted Alma rating numbers. This will be given by the SCYU.

Measuring the boat.

To calculate the Alma rating several measures on the boat are needed. None of them are strange and most of them are in the back head of the owners. The only two measures which usually are difficult are the displacement and the waterline length. Most owners have not weighted their boat, at least not recently. The displacement is always given on the drawing, but then it is too low. After the boat has been built and used for some years it will be much heavier. Try to get as good estimation as you can.

Regarding the waterline length it is easier. On land hang a weight from the stem and the transom, and measure the distance to the “shit line” on the hull. In the water hang a weight perpendicular to the crossing of the stem and the water surface and measure the distance to the stem on deck. The same goes in the aft.

The SCYU will accept the measures you give, unless they are obviously erroneous or misunderstood. You will be asked to give them when you send in your application for participation. We will also publish all underlying data of the boats and their Alma rating on our home page.

All measures are in the metric system.

For the hull the following measures are needed:

Loa   Length over all exclusive of rudder hung on the transom, and exclusive of any bowsprit or bumpkin.
Lwl   Waterline length in the condition of the boat as used.
B   Largest width of the boat, at decklevel or below if the boat has tumblehome. Any rubbing strake is excluded.
T   Largest depth of the hull, including a centerboard if that is at hand
D   Displacement for the boat as used.
Kf   Keel form, which for m of the keel fits the description below.

For the rig the following are needed:

P Useable length of the mast leech. If measure marks are at hand use distance between them, else from the upper edge of the boom to the lower point of the sheave for the main halyard.
Py Useable length of the mizzen mast.
Pg Length between the boom an the gaff claw for a gaff rigged boat.
E Useable boom length or distance between marks.
Eg Useable length of the gaff, from claw to peak.
Ey Useable mizzen boom length.
I The height of the fore triangle from the deck plane. If the mast is on a superstructure the height of this shall be added.
J Length between the forward surface of the mast and the fore stays prolonged crossing of the deck plane.
Lpg The distance perpendicular to the fore stay to the sheeting horn of the largest foresail (genoa) to be used.

Other information of interest.

Type of boat (Sloop, yawl, schooner, skerrycruiser, R-yacht, Cube rule, etc., etc.)
Designer
Year of design
Shipyard
Material of the hull and superstructure
Engine, type and power rating
Other interesting info about the boat, which people might be interested in, special conditions, history, etc.

Definition of factors in the Alma rule:

L
Length over all. Excluding any rudder hung on the transom, any bowsprit or bumpkin.

B
Maximum width of the hull, either at deck level or below if the boat has tumblehome. Exclusive of any rubbing strake.

T
Largest depth of the hull, inclusive of any centerboard in its deepest position.

S, Sc
Sail area. The sailarea is calculated as the sum of the geometric triangular surfaces. For a yawl, ketch or a schooner the mizzen area is included in the main sail area. The arithmetic area S is adjusted by the rig factor Rf. Rf multipled with S gives Sc.

D, Dc
The Displacement in metric tones for the boat as used The displacement D is adjusted with an Age factor Af and a keel factor Kf. The corrected displacement DC is calculated by division of D with Kf*(1+Af).

Lvl
Waterline length

Rf

The rig factor, which describes the efficiency of the rig. A modern efficient rig has a Rf of just above 1.1, while a gaff rig has a rig factor of 0.85. The factor is calculated by the equation Rf = (0.777+0.074*AR). AR is the aspect ratio of the rig. The AR ranges from just below 5 for the best modern rigs, while a gaff rig has 1- 1.5. The aspect ratio AR is calculated as the highest mast height in square divided with the sail area. (Or the span divided with the chord.)

Kf

Keel factor. For a further description, see sketches below.

1) Full keel on a plummed stemmed cutter or similar. 0.90
2) Long keel with a curvature, which gives a relatively straight line sloping from the stem and backwards, like on meter boats from the second rule. 0.95
3) A long keel without any straight lines in the side view, typical on clipper bowed boats from the first years after 1900, or also on Stormy Weather. 0.98
4) A long keel with a curved front part, undercut and then going down to a mainly horizontal part until the rudder. Typicaly on almost all skerry cruisers, R-boats, most cruisers from the 50'ies and and many others. 1.0
5) A long keel, still with the rudder attached to the trailing edge but built like a fin keel on a plank in the bottom of the boat and the length of the keel is less than ¾ of the water line length. Like on the Swedish type Neptun kryssare. 1.02
6) All under water bodies, where the rudder is clearly separated from the keel but hung on a skeg, like many IOR racers from the 60'ies and 70'ies as Swan 36. 1.05
7) All fin keeled boats with a spade rudder. 1.08

Af

The Age factor. The age factor is taken from the table below. If a boat is tounger than from 1975, then 0.01 is added per year. The table is stolen from CIM.

1975	**0,045**	1942	**– 0,016**	1909	**– 0,136**
1974	**0,044**	1941	**– 0,018**	1908	**– 0,139**
1973	**0,043**	1940	**– 0,020**	1907	**– 0,142**
1972	**0,042**	1939	**– 0,022**	1906	**– 0,145**
1971	**0,041**	1938	**– 0,025**	1905	**– 0,148**
1970	**0,040**	1937	**– 0,028**	1904	**– 0,150**
1969	**0,038**	1936	**– 0,030**	1903	**– 0,152**
1968	**0,036**	1935	**– 0,032**	1902	**– 0,153**
1967	**0,034**	1934	**– 0,034**	1901	**– 0,154**
1966	**0,032**	1933	**– 0,036**	1900	**– 0,155**
1965	**0,030**	1932	**– 0,038**	1899	**– 0,156**
1964	**0,028**	1931	**– 0,041**	1898	**– 0,157**
1963	**0,026**	1930	**– 0,044**	1897	**– 0,158**
1962	**0,024**	1929	**– 0,047**	1896	**– 0,159**
1961	**0,022**	1928	**– 0,050**	1895	**– 0,160**
1960	**0,020**	1927	**– 0,054**	1894	**– 0,161**
1959	**0,018**	1926	**– 0,058**	1893	**– 0,162**
1958	**0,016**	1925	**– 0,062**	1892	**– 0,163**
1957	**0,014**	1924	**– 0,066**	1891	**– 0,164**
1956	**0,012**	1923	**– 0,070**	1890	**– 0,165**
1955	**0,010**	1922	**– 0,075**	1889	**– 0,166**
1954	**0,008**	1921	**– 0,080**	1888	**– 0,167**
1953	**0,006**	1920	**– 0,085**	1887	**– 0,168**
1952	**0,004**	1919	**– 0,090**	1886	**– 0,169**

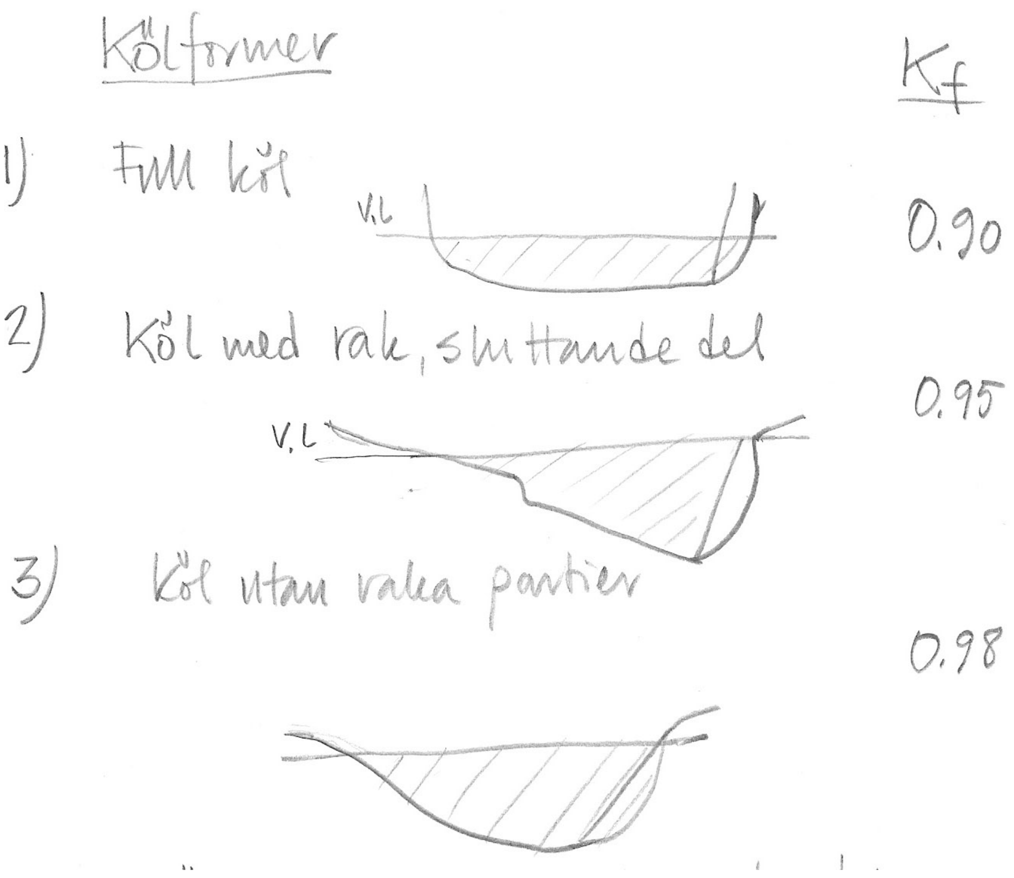
1951	**0,002**	1918	**– 0,095**	1885	**– 0,170**
1950	**0,000**	1917	**– 0,100**	1884	**– 0,171**
1949	**– 0,002**	1916	**– 0,105**	1883	**– 0,172**
1948	**– 0,004**	1915	**– 0,110**	1882	**– 0,173**
1947	**– 0,006**	1914	**– 0,115**	1881	**– 0,174**
1946	**– 0,008**	1913	**– 0,120**	1880	**– 0,175**
1945	**– 0,010**	1912	**– 0,124**		
1944	**– 0,012**	1911	**– 0,128**		
1943	**– 0,014**	1910	**– 0,132**		

Spf
Spinnaker factor. A boat using a spinnaker or a gennaker get Spf = 3. A boat not using a downwind foresail at all get Spf =0

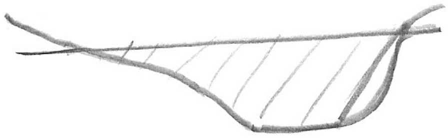
S
Sail area, which is calculated as follows:

Main saill (bermuda or any other triangular sail): Am = P* E/2
Main sail gaff Amg = Pg*0,54*(E+Eg)
Mizzen Ami = Py*Ey/2
Foresail Af = (I*J/2 + I*Lpg/2)/2
(Foresail area is the mean area of the fore triangle and the largest genoa to be used)

Description of the different keel factors



4) Köl med relativt rak underdel



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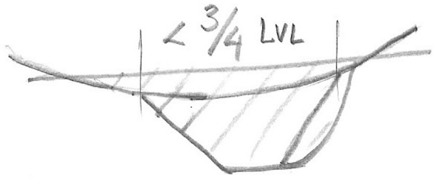
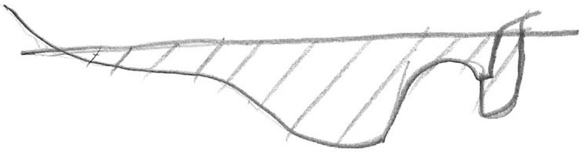
5) Köl på båt, byggd på planka



1.02

6) Köl med roder på skeg



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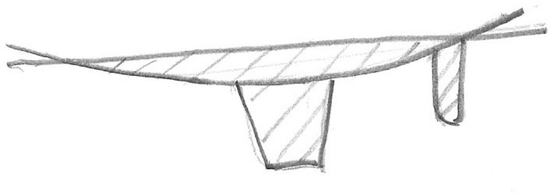
7) Fenköl med spadroder



1.08