

Race Committee and Mark Laying
Duties and Procedures

Version 5
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Race Committee and Mark Boat Duties and Procedures

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1 Procedures

1. Mark boats shall be crewed by two people.
2. GPS shall be set on nautical miles (decimals), magnetic bearings, and WGS 84 Map datum. (See page 21 Using the GPS)
3. All times will be derived from GPS time.
4. Laser range finders to assist with starting and finishing line lengths, for setting the distance between gate marks and for the offset mark on a windward leeward course shall be set in metres. Laser range finders for gates and finish lines. There will be no offset marks. As start line lengths get longer, its OK to use GPS.
5. The middle of the gate 4S/4P will be the reference point for laying the course unless the Signal Boat advises differently because of a mark change.
6. The reference point when changing the position of a mark for a course change will be the other mark of that leg (i.e. mark 1 for mark 4S/4P and vice versa and mark 2 for mark 3S/3P and vice versa).
7. The race committee boats of each course area will leave the marina together and will make their way to the course area together.
8. Course changes will be made to reconfigure the course to a new wind or to adjust the length to meet the target time. Or a change in current.
9. Change marks will be the same shape and colour as the original marks except they will have a black horizontal band.
10. An initial reference point and an anticipated course axis and length will be determined by the Race Officer by at least start minus 65 minutes. A final reference point will be broadcast by start minus 15 minutes.
11. Mark Boats One, Two and Three will be on station in approximate mark position at start minus 60 minutes and have taken first wind reading by this time.
12. During the period start minus 60 to start minus 15 **Mark Boat Four** will be half way up the anticipated windward beat and on the starboard layline to mark 1 (i.e. on the extreme right of the course). **Finish Pin** will be half way up the outside loop and on the port layline to mark 2 (i.e. on the extreme left of the course). **Finish** will be half way up the course in the middle of the course area. This is to take wind readings to ensure there is a consistent breeze across the racing area. Apart from the **Signal Boat** all boats will remain drifting at this time.
13. **Start Pin** will take tide readings from the **Signal Boat** or another fixed mark. **Better to use a mark. There can be a back eddy with large anchored boats.**
14. Tide readings will be made every 15 minutes once marks are laid (being mindful of keeping out of the way of the racing fleets).
15. At start minus 15 minutes **Finish, Finish Pin** and **Mark Boat Four** move to their approximate positions. Mark 4 now takes wind and tide readings from the Mark 4 position.
16. The final course axis and length will be determined by start minus 10 minutes. At this time Start Pin will be anchored and **Mark Boat Four** will lay or adjust the coach boat marks below the starting line. Mark 1

will be laid by the warning signal, Mark 2 and Mark 3 gate soon after, and Mark 4 gate as soon as possible after the start of the second start. Finish and Finish Pin should be laid before the racing boats round Mark 2 for the last time. (or Mark 1 if a W/L) A Marshall boat will lay the coach boat marks below the finish.

17. The Mark 3 gates should be directly downwind of Mark 2 (using wind adjusted for the effect of current). If the angle is greater than $\pm 5^\circ$ degrees different than that signalled on the Signal boat as the course axis then a change of direction should be signalled at Mark 2.
18. Once marks are laid the Latitude and Longitude of each mark will be recorded and radioed to the **Signal Boat**. Mark boats will also record this information so that range and bearing from any mark may be used for course changes. In particular Mark Boats One and Four will share their positions and likewise Mark Boats Two and Three.
19. During the race wind speed and direction will be monitored every 5 minutes and current measured every 15 minutes. Any change of 10° or more which appears permanent will be transmitted to the **Signal Boat**.
20. Mark roundings will be recorded by mark boats, where possible, and the times of first and last of each fleet radioed to the **Signal Boat** as each happens. They should also tell the Signal Boat when the first boat is 2 or 3 minutes from the mark. The Signal Boat will then advise whether or not there will be a course change.
21. When signalling a change at Mark 1 or Mark 2 (or signalling the turning on or off of Rule 42) a mark boat will be stationed 10 fleet boat lengths away and in a direction which is at right angles to the direction of the course from the last mark and on the starboard side of the boats as they round the mark. Mark boats shall anchor only when signalling a course change, or turning on or off Rule 42 or signalling a mark missing.
22. At a gate mark the boat signalling a change will be 5 boat lengths downwind between the gate marks.
23. All mark boats may be required to inform racing boats that they were identified as OCS or BFD, by individually pointing flag X, drawing attention by sounding 1 blast on a horn and displaying the boat's country code card. There should no hail of the country code. As noted in the ISAF Race Management Policies the notification may be later in the race if the mark boat might interfere with boats racing to make the notification, A couple of other thoughts – ghet close enough so that the boat can read the card. The boat making the notification should record the date and time the notification has been made.
24. Marks shall be carried on mark boats inflated. Change marks shall be covered over during racing. Also, of an original mark is pulled out of the water due to a course change, it should be covered.
25. Marks shall be stowed inside the boat from the harbour to the race course.

2 Mark Boats, Call Signs and Responsibilities

There will be 4 mark boats, one start pin boat, one finish pin, a finish boat, a signal boat, a marshal boat, and safety boats.

Mark boats will be assigned as follows:

Trapezoid Courses

MARK BOATS and Call Sign

Mark Boat One

Mark Boat Two

Mark Boat Three

Mark Boat Four

RESPONSIBILITY

mark one, change mark

mark two, change mark

mark 3S and 3P, change marks

mark 4S and 4P, change marks, coach boat marks below the starting line. If the marshall boat is setting the coach boat marks, should that boat have the marks.

Finish Pin

finish pin, coach boat marks below mark 3 and finishing line. Same comment about the coach boat marks.

Finish Boat

finish

Start Pin

start pin (Port end starting line)

Signal Boat

starboard end starting line

Windward Leeward Courses

MARK BOATS and Call Sign

Mark Boat One

Mark Boat Three

RESPONSIBILITY

mark one, change mark (and mark 1A if needed)

mark 4S and 4P, change marks, coach boat marks below the starting line and assisting start / finish pin and Mark Boat Four Same comment about the coach boat marks

Mark Boat Four

mark 4S and 4P, change marks, coach boat marks below the starting line

Start Pin

start pin (Port end starting line)

Signal Boat

starboard end starting line, Finish Pin (port end of finishing line)

Finish Boat

Finish (on the port side of the Signal Boat)

For All Courses

Marshal One

Overall control of safety, support boat movement and spectator craft.

Rescue One, Two

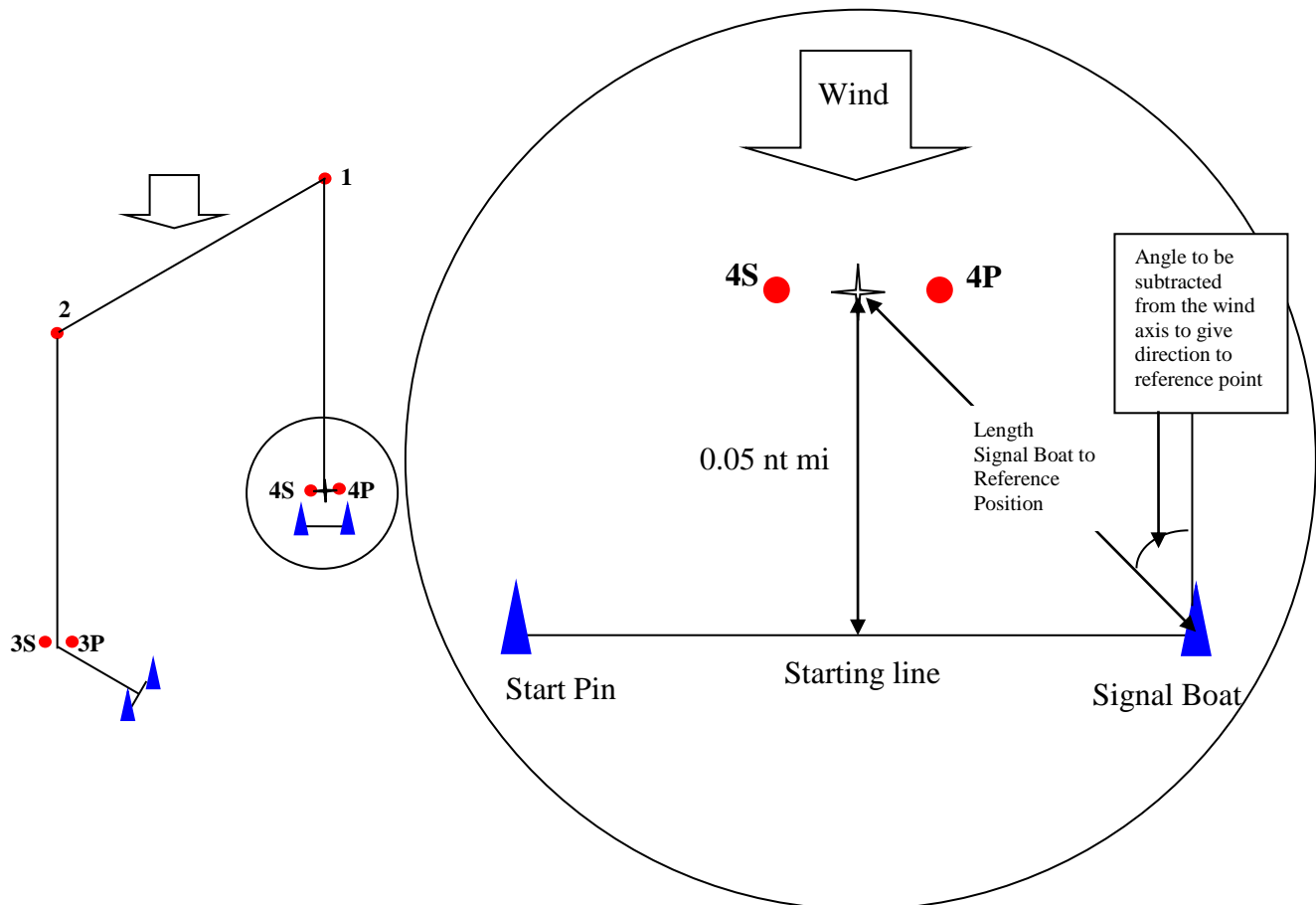
These boats are the first response for competitor safety in the event of injury or other mishap. They should follow the fleet in accordance with the safety plan taking their direction from **Marshal One**. In really foul weather all mark laying boats would assist with safety and should be trained in facilitating a rescue of both sailors and equipment.

Daily Schedule Example – Actual times may vary

Real Time	Time in relation to first start	Action
8:50	-4.00	Meeting Lead IROs, National ROs & DROs with PRO FOP Competition Manager & Chairman RM (Will Rob Andrews actually be at that meeting?)
9:30	-3.30	Meeting each IRO with ITOs of their course
10:00	-3:00	Team Leaders meeting
10:45	-2.15	IROs and National RO and Deputies meet with whole team on the dock to explain the day's procedure.
11:00	- 2:00	Check of equipment on board and that all systems function and are stowed correctly. Pick up lunches, water, radio, paper work. First rescue boat launched and available to escort sailors to the race area.
11:15	-1:45	Race committee boats leave the marina together for the race area. Radio check completed. (Some course areas may need to leave earlier)
11:45	-1:15	Signal boat on station anchored in the anticipated start position.
11:55	-1:05	Initial reference position determined by Race Officer and radioed to all mark boats with anticipated course axis and length (using actual wind observed by committee boat on the way to the course area and from weather forecasts).
12:00	-1:00	All mark boats in approximate positions starting to take wind readings.
12:00	-1:00	Initial wind speed and bearing radioed to Signal Boat . Wind now monitored at least every 5 minutes - any significant change reported to Signal Boat . This will be continued for the duration of racing. Use GPS to estimate current flow. Complete time check with timekeeper.
12:30	-0:30	Wind speed and direction updated to Signal Boat .
12:50	-0:15	Finish, Finish Pin and Mark Boat Four move out of the course area to their approximate positions. Start Pin moves to anchor. Final adjustments of Starting line direction made by the preparatory signal. The Signal boat determines the final reference position and transmits it to all boats. Mark Boat Four adjust the coach boat mark below the signal boat and lays the coach boat mark below Start Pin.
12:55	-0:10	Course axis and length confirmed by Race Officer. Mark boats move into final position to lay marks.
1300	-0:05	Warning Signal. Last adjustments to starting line.
1301	-0:04	Preparatory Signal. Mark 1 laid by this time.
1305	0:00	Starting signal of first class to start. Mark 2 laid by this time.
	+0:10 (Approx)	Mark 3 Gates laid.
	During the race	Mark boats continue to record wind speed and direction at least every 5 minutes and monitor the position of the mark, report significant wind changes to Signal Boat and any movement of the mark. Measure tidal flow every 15 minutes when possible (i.e no racing boats in the vicinity). Record every boat (sail number and time) as they round the mark every time. Report to the Signal Boat the time of first and last round the mark as they round the mark.
	Course change (signalling)	On instruction of Race Officer move to correct position to signal a course change. Deploy correct signals and sounds when the course change is confirmed by Race Officer.
	Course change (moving the mark)	Move to a new position as indicated by range and bearing from Race Officer and deploy mark if required. Remove old mark as soon as possible.
	End of Racing	Retrieve all marks.
	Back at the dock	Refuel, tidy up, stow all gear and report any damage or lost gear to equipment officer. Return all paper work to the Signal boat. Return radio for charging.
	Race end + 60 minutes	Team de-briefing.

5 Laying the Start Pin

1. Receive GPS position of the signal boat from the signal boat or ping the signal boat. The starting line length will be given by the RO.
2. Proceed out at about 100 degrees (angle to sailing wind) on the port side of the signal boat to the desired distance. Use GPS and **Laser Range Finder** to help determine this distance.
3. Turn to move slowly directly into the sailing wind and under direction of RO, note the position that he advises is the desired location of the pin.
4. Take a compass heading to the signal boat from this spot and continue to weather. Actually, go out on the angle that the signal boat is laying to the wind and current.
5. Go to weather (see point 4, above) to gain enough distance to: (See page 34):
 - a. get a good set, and the proper rode/scope minimum of four times the depth of water
 - b. add enough rode so you can move up 5 degrees if requested (10 m for every 100 m of starting line length)
 - c. have enough rode to move back 5 degrees
6. After anchoring move back to compass position.
7. Check location using a compass.
8. Continue to monitor position with a compass.

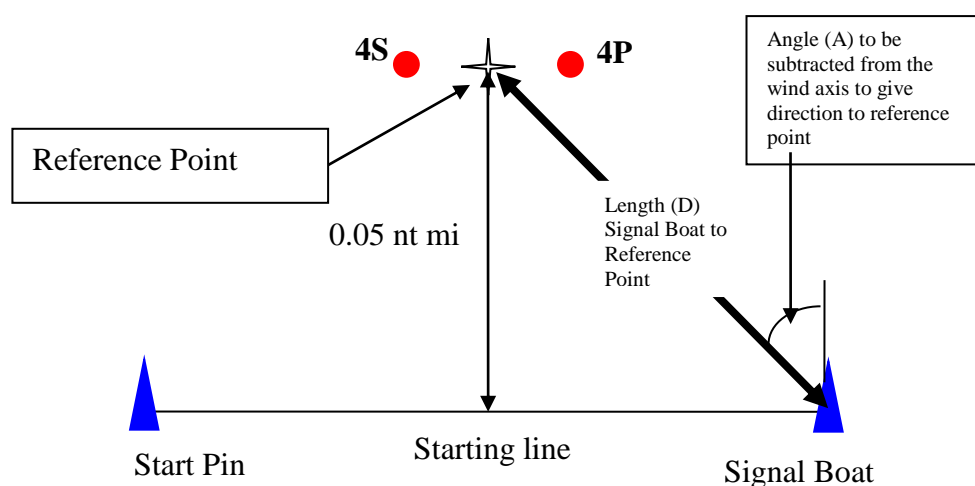


6 Start line Lengths

Event	Boat Length (metres)	Multiplying factor	Number of Boats	Start Line Length	
				(metres)	Nautical Miles
RS:X Men	2.86	3	38	320	0.20
RS:X Women	2.86	3	28	240	0.13
Finn	4.54	1.5	25	170	0.09
Laser	4.24	1.5	48	300	0.16
Laser Radial	4.24	1.5	39	250	0.13
470 Men	4.7	1.5	27	190	0.10
470 Women	4.7	1.5	20	140	0.08
49er	4.9	2	20	200	0.11
Star	6.92	1.5	16	190	0.10
Women's Match Racing	6.18	-	12	70	0.04

In strong current and higher winds and waves these lengths may need to be increased. When two or more fleets are using the same starting line it may be better to compromise these lengths (some longer and other shorter) to leave the starting line alone rather than delay starts to reset the line at the optimum length.

7 Determining the Reference Position (see page 22 for GPS instructions)



Starting Line		Length (D) Signal Boat to Reference Point	Angle (A) to subtract from Course Axis.
Length (m)	Length (nt mi)		
80	0.04	0.05	23
90 - 100	0.05	0.06	27
110 - 120	0.06	0.06	32
130	0.07	0.06	35
140 - 150	0.08	0.06	38
160 - 170	0.09	0.07	42
180 - 190	0.10	0.07	45
200 - 210	0.11	0.07	48
220 - 230	0.12	0.08	50
240 - 250	0.13	0.08	52
260	0.14	0.09	55
270 - 280	0.15	0.09	56
290 - 300	0.16	0.09	57

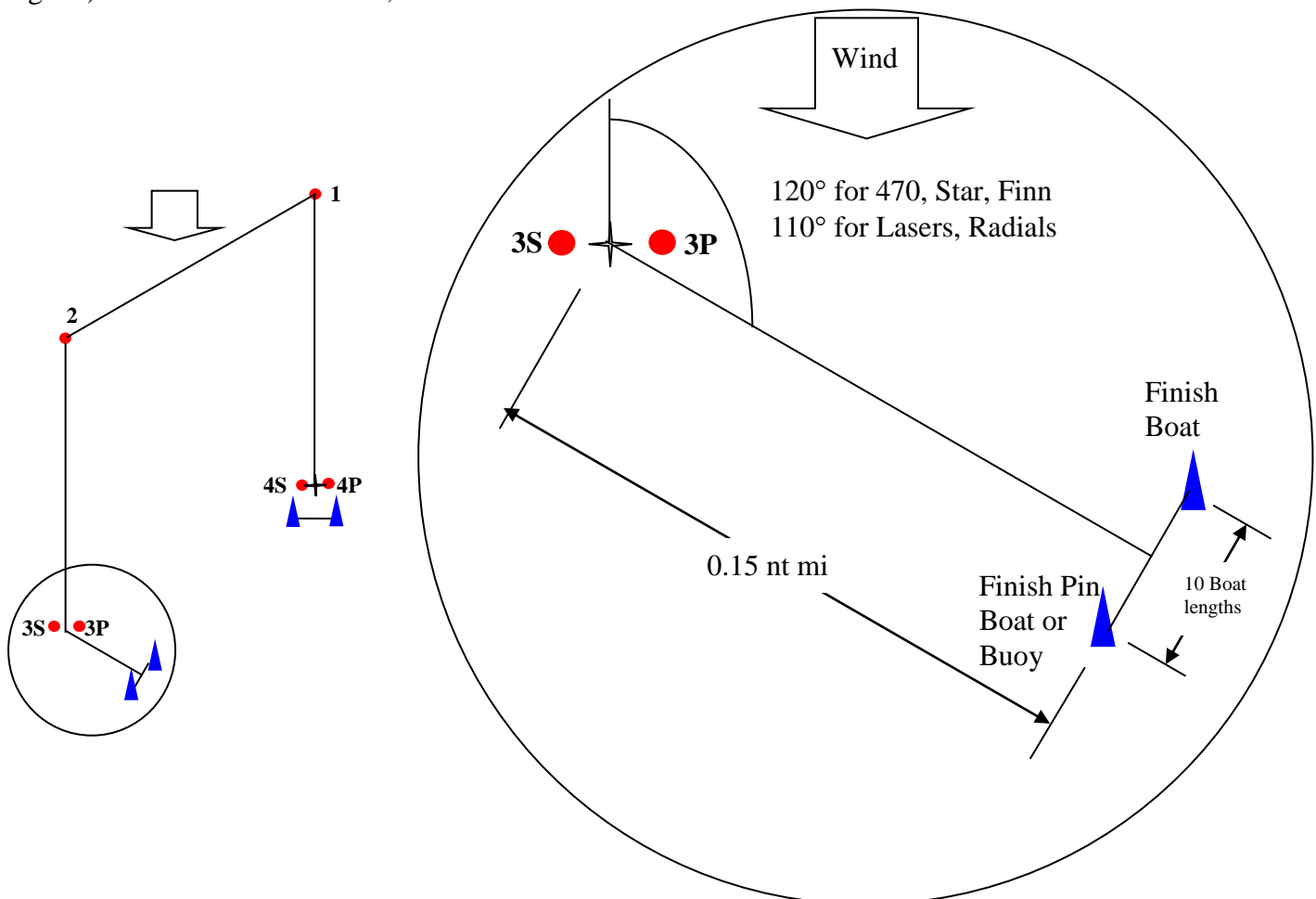
8 Starting Line Adjustment

When the starting line is set the following table gives the distance in metres that a 1, 3, 5 or 10 degree change, in either the signal boat or pin boat position, will make for the varying starting line lengths, this assumes that the change is made either directly upwind or downwind.

Starting Line Length (metres)	Starting Line Adjustment in metres			
	1 degree	3 degrees	5 degrees	10 degrees
80	1	4	7	14
90 - 100	2	5	8	17
110 - 120	2	6	10	20
130	2	7	11	23
140 - 150	3	8	13	25
160 - 170	3	9	14	29
180 - 190	3	10	16	32
200 - 210	4	11	16	36
220 - 230	4	12	20	39
240 - 250	4	13	21	43
260	5	14	23	46
270 - 280	5	14	24	48
290 - 300	5	15	26	52

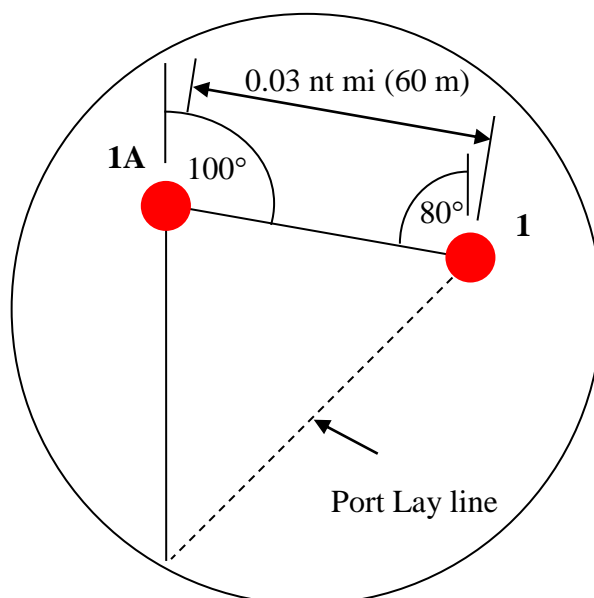
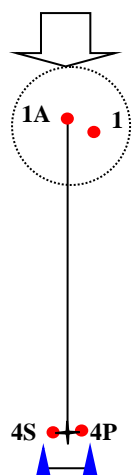
9 Laying the Finishing Line

Use the same procedures as the start pin except the distance is 10 boat lengths (for most dinghy fleets 50 m is good) For downwind finishes, 50 m for all but 49er. 75 m for 49er



10 Laying Mark 1 with an Offset mark

1. Lay the offset mark first using the range and bearing from the Reference Point.
 2. Ping the offset mark and proceed to starboard at plus 90° to the course axis for approx 40 meters using a rangefinder to help determine this distance
 2. Read back the reciprocal heading.
 3. If the wind has been showing a tendency to veer right set the mark at course axis plus 100°
 4. If the wind has been showing a tendency to veer left set the mark at course axis plus 90°
 5. To anchor, move the mark boat to weather to achieve the objective with appropriate Rode/scope.
- Add that finish line lengths are always measured by laser range finder, not GPS



11 Distance between Gate Marks

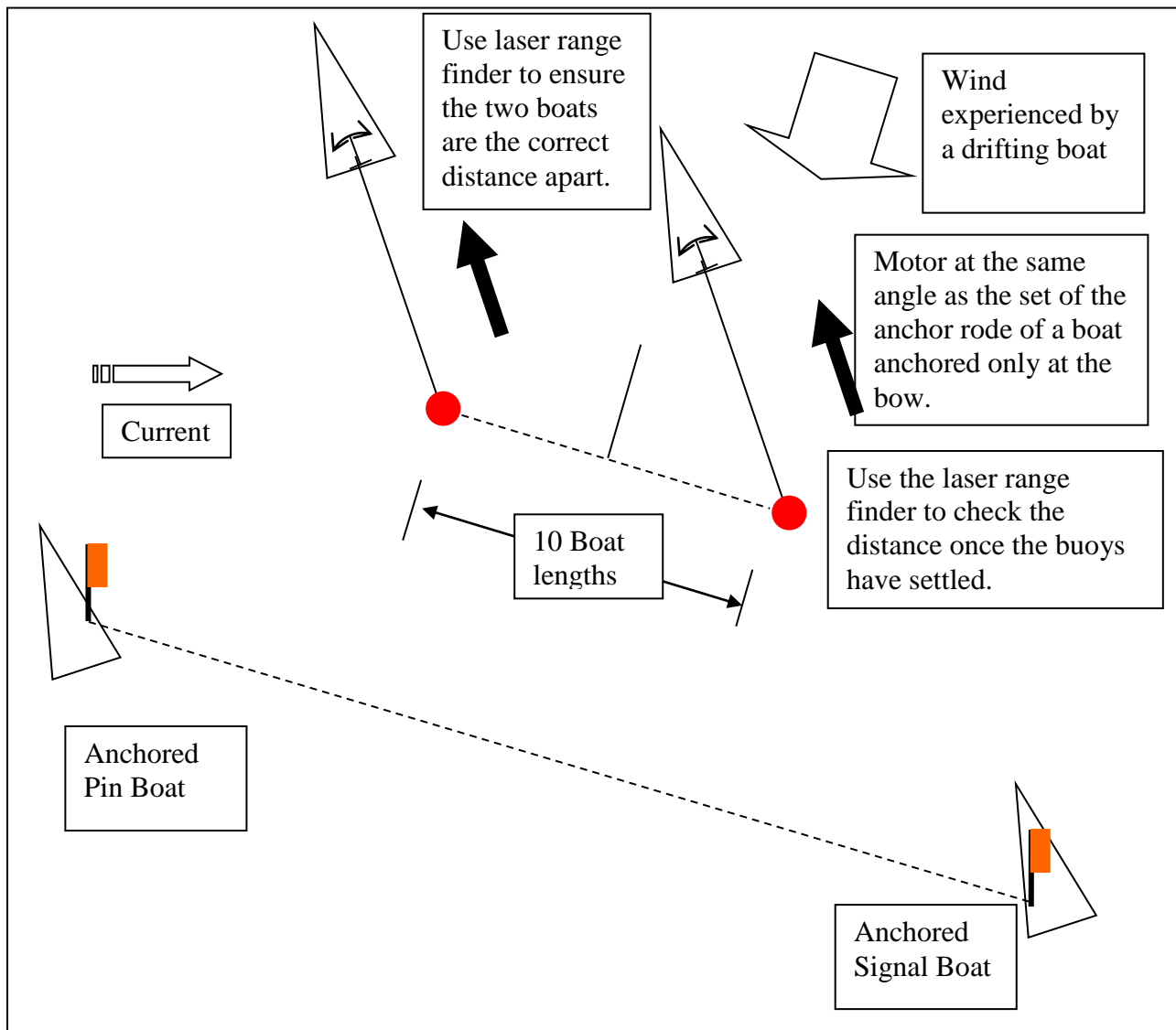
Event	Boat Length (metres)	Multiplying Factor	Distance (metres)
RS:X Men	2.86	14	40
RS:X Women	2.86	14	40
Finn	4.54	10	50
Laser	4.24	10	42
Laser Radial	4.24	10	42
470 Men	4.7	10	50
470 Women	4.7	10	50
49er	4.9	10	50
Star	6.92	10	70

12 Laying the Gate Marks - Two boats

Add that distance should always be measured by laser range finder - not GPS.

Add that the rule of thumb is that the gate should always be set to the sailing wind.

1. Both boats move together from behind the starting line (or below the position of Mark 3) and stream the mark and all the chain/Rode trailing behind with only the anchor in each boat.
2. The boats should cross the starting line together to keep the bearing between the boats as sailing wind axis plus or minus ninety degrees. The distance between the boats is estimated to be the correct distance between the gate marks C Cook note – this may not necessarily be the course axis signalled.
3. On direction of the RO, drop both anchors simultaneously.
4. When there is significant current the boats should motor in a direction that the anchor rode of the marks will be when finally anchored – watch the way in which the signal boat is laying.
5. An imaginary line between the two marks should be at right angles to the wind direction.
6. Adjust as required:
 - (i) by dragging the windward one of the two marks downwind.
 - (ii) by adding extra warp to the windward one of the two marks.



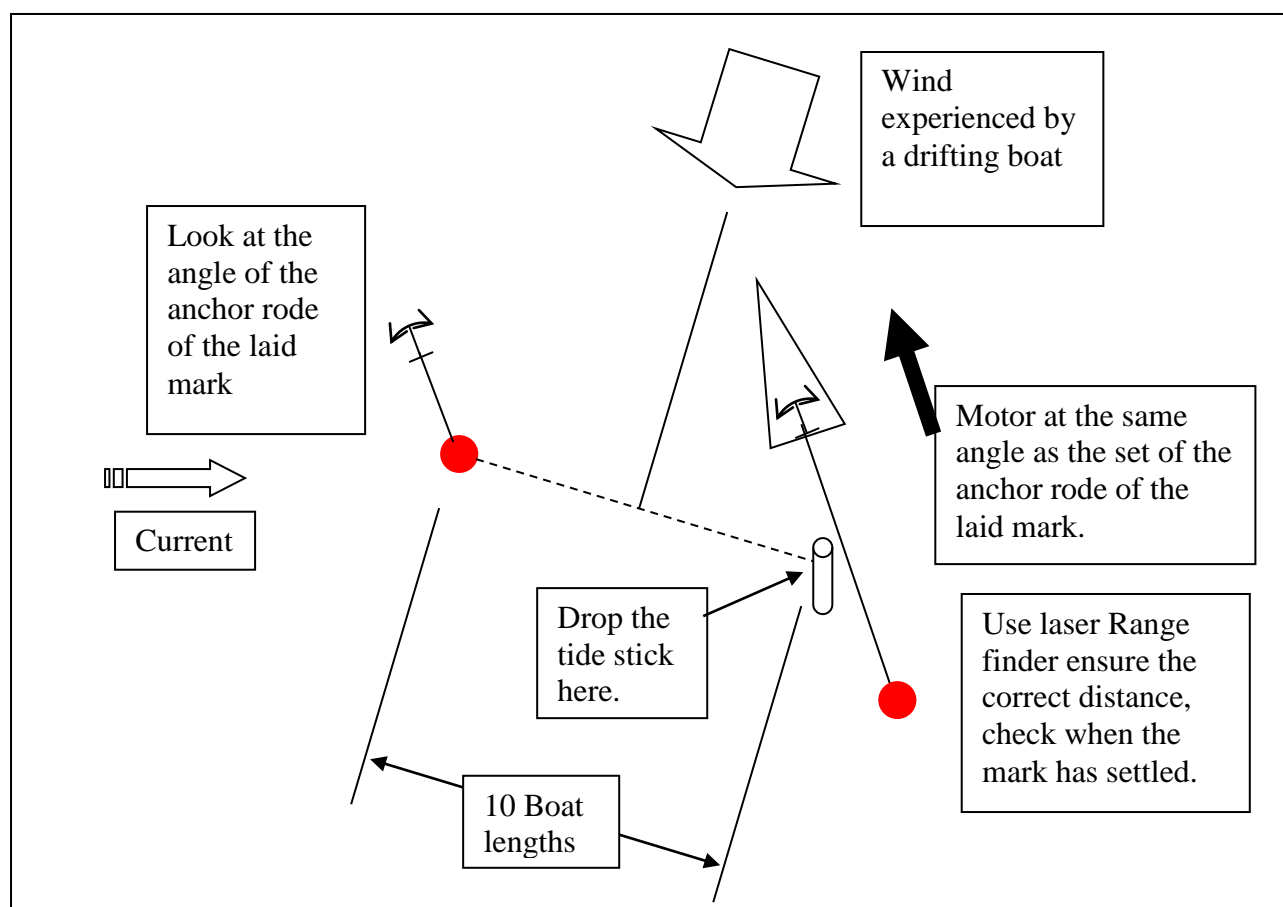
13 Laying the Gate Marks - One boat

MINOR TO NO CURRENT

- 1 When instructed to lay the gate, go to the Mark 3 position by range and bearing from the reference position to lay 3S/3P (or to the reference position to lay 4S/4P).
- 2 Look up the course to check that this is downwind of mark 2 (or mark 1) and adjust if it is not.
- 3 Motor to port (looking up the course) a couple of boat lengths and lay mark 3S by lowering the anchor while keeping some weight on the warp. (This is the left hand mark as you look up the course).
- 4 Check that the mark is sitting upright and that the anchor is holding.
- 5 Return downwind of this mark and this time trail the mark and the warp with just the anchor aboard the mark boat.
- 6 Motoring slowly to weather, pass mark 3S on your port side an estimated distance of around 10 boat lengths (12 boat lengths if high wind).
- 7 When the compass bearing of mark 3S is “wind axis minus 90°”, drop your tide stick in the water to mark the location you wish the mark to come to rest.
- 8 Continue motoring until the mark you are towing gets to about 3 m downwind of the tide stick, drop the anchor.
- 9 The marks should be at right angles, relative to the wind.
- 10 For small adjustments drag the windward mark downwind.
- 11 For large adjustments pick up one mark and relay.

STRONG CURRENT

Follow the above procedure. Before returning downwind, observe the angle of the anchor rode of mark 3S. It is this direction that you should motor when towing the second mark.



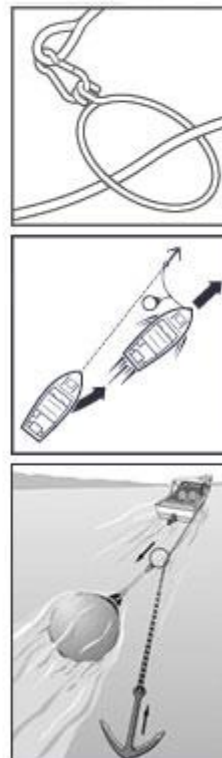
14 Anchor Retrieval

The following technique is useful when the anchor and chain is heavy or when the warp is long (greater than 30 metres).

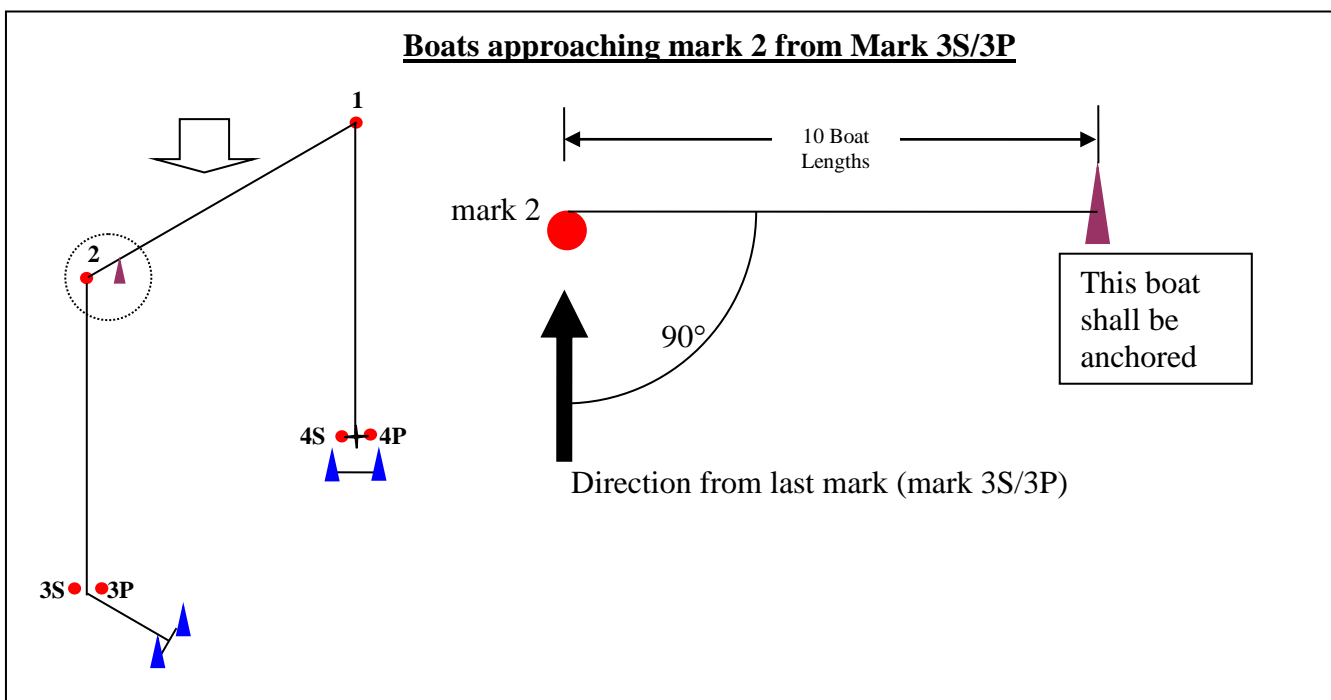
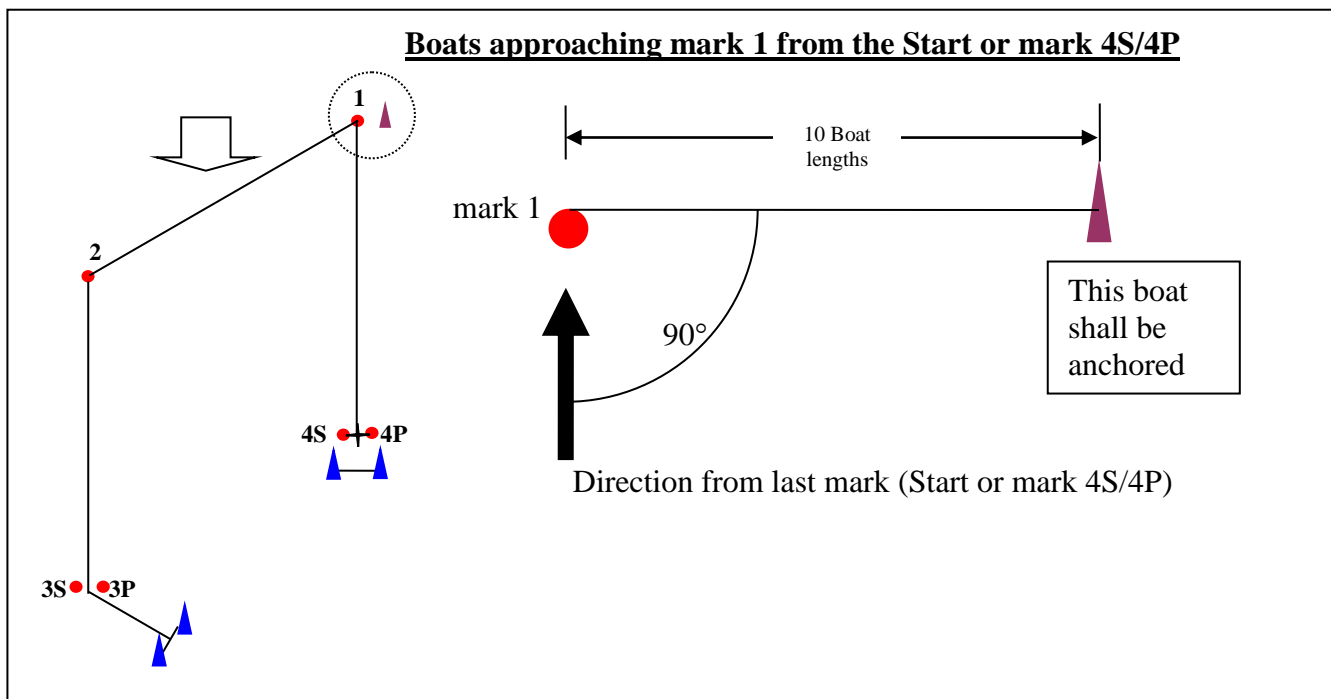
- 1 Approach the mark from downwind or down current in the normal way and retrieve the mark and counterweight.
- 2 Tie off the warp to a strong point on the hull of the mark boat.
- 3 Attach the retrieval buoy to the warp and allow it to slide down the warp into the water.
- 4 Motor away (upwind or up current) at a speed of about 5 knots and at an angle of about thirty degrees from the direction of where the anchor is thought to be.
- 5 Ensure at all times that the warp is clear of the motor and propellers.
- 6 The retrieval buoy will slide down the anchor warp. It will be clear when it has reached the anchor as there will be more spray around the buoy.
- 7 Stop and then return slowly towards the retrieval buoy hauling in the warp.
- 8 Repeat if necessary.

How does the Anchor Ring work?

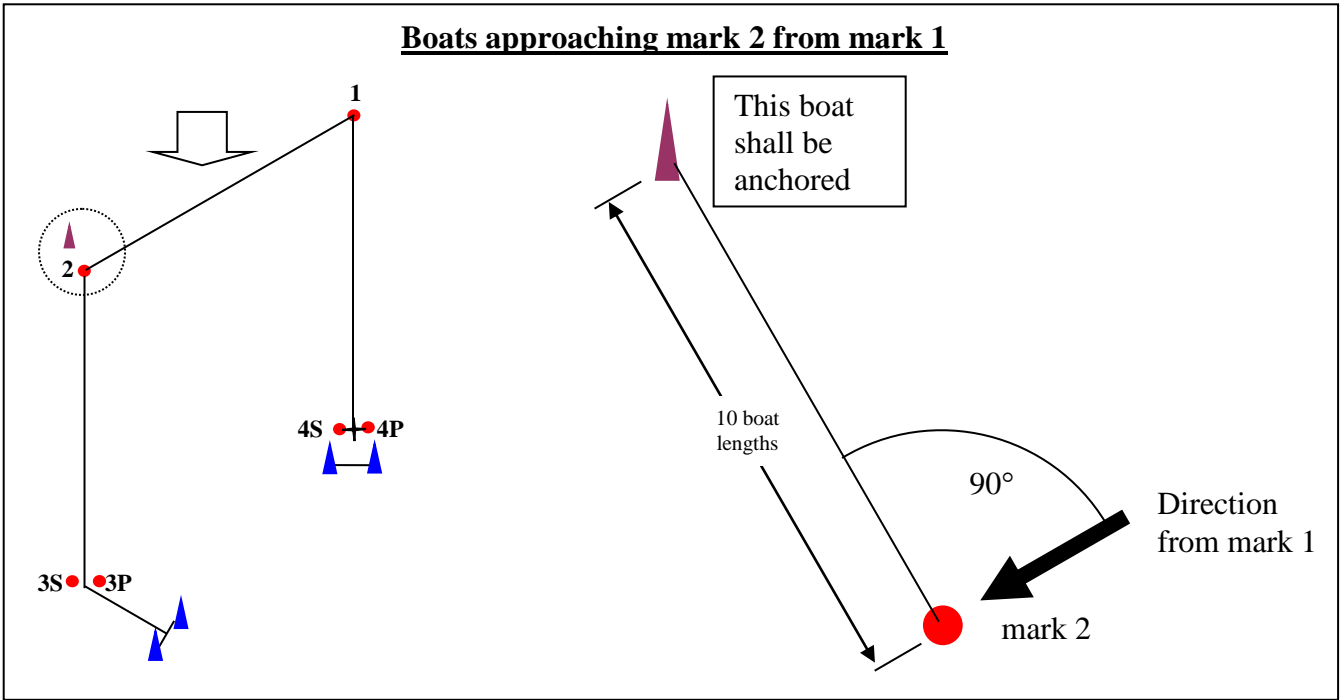
1. Slip the Anchor Ring over the anchor line. Attach the shackle-buoy assembly. Be sure to snap the shackle through both eyes of the ring. Toss the buoy into the water allowing the ring to slide down the line.
2. Motor your boat at a 30 degree angle off of your anchor point, taking care to keep the anchor line clear of the props. Proceed slowly (roughly 5 knots) until the anchor is released from the bottom. Then increase speed slightly (6 to 8 knots).
3. The anchor line will slide through the ring as the buoy floats to the surface. Once the anchor has reached the surface, shift into neutral and pull in the slack anchor line and anchor. The anchor chain will counterbalance the anchor and hold the anchor at the surface.



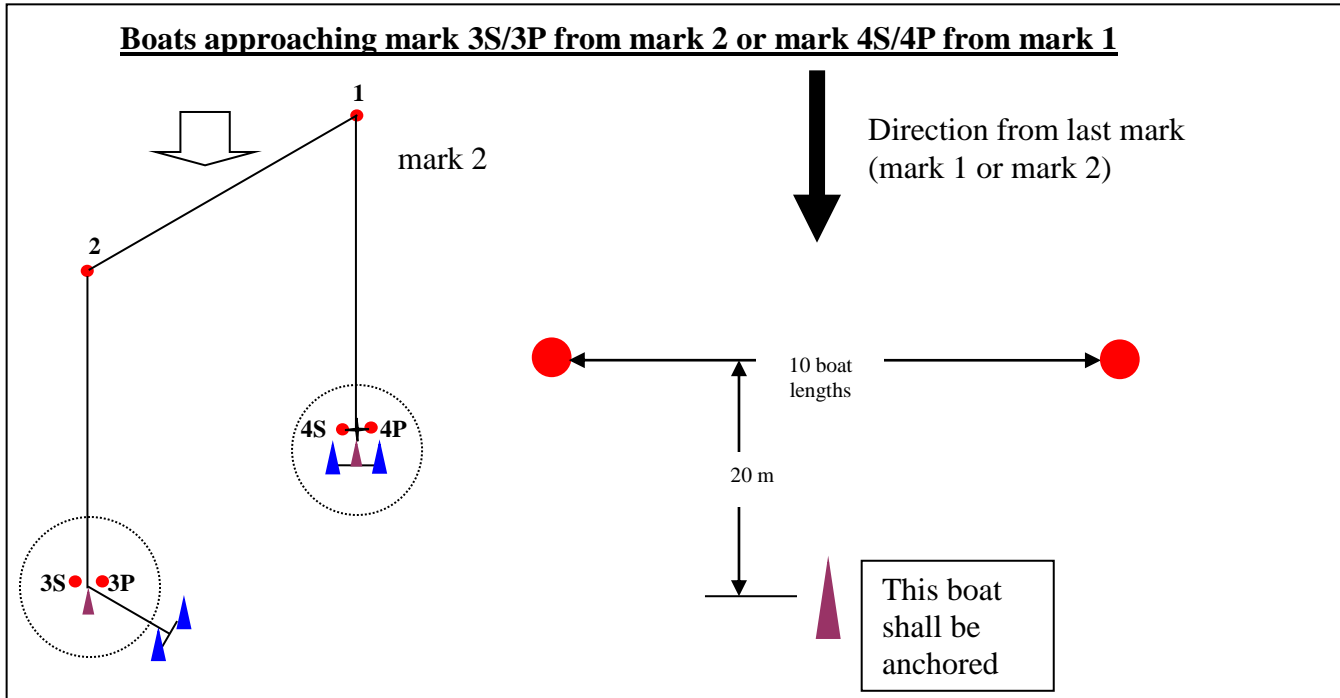
15 Positions of Course Change Signal boats.
(and boats signalling the turning on and off of Rule 42)



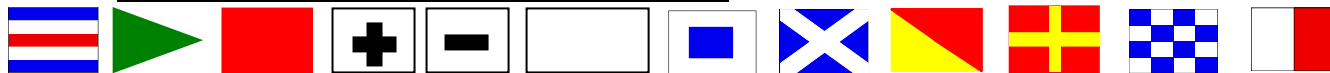
Boats approaching mark 2 from mark 1



Boats approaching mark 3S/3P from mark 2 or mark 4S/4P from mark 1



16 Visual Signals displayed by Mark Boats



Change of Course - Flag C		
	(- - - - -) Repetitive sounds while the signal is displayed	The position of the next <i>mark</i> has been changed. This signal is displayed with a red or green shape or flag for sailboards or with a board displaying the compass bearing of the next mark for other classes. Displayed with a board showing a “+” means the length of the leg has been increased. Displayed with a board showing a “-” means the length of the leg has been reduced.
Example	(- - - - -) Repetitive sounds while the signal is displayed	Displayed on sailboard courses, means the next mark is to starboard of the original.
Example 	(- - - - -) Repetitive sounds while the signal is displayed	This signal means the direction of the next leg for the laser class is 040° and it has been lengthened. Use 000 for due north.
Shorten Course – Flag S		
	• •	The course has been shortened. Rule 32.2 is in effect. Display as soon as the leading boat can hear and see the signal. Two sounds for the first boat only.
Mark Missing – Flag M		
	(- - - - -) Repetitive sounds while the signal is displayed	The object displaying this signal replaces a missing <i>mark</i> .
Changes to Rule 42 – Flags O and R for 470 and Finn classes		
O R	(- - - - -) Repetitive sounds while the signal is displayed	Flag O turns Off aspects of Rule 42. Flag R Returns all of Rule 42.
Abandonment – Flag N and N over H		
	<input type="checkbox"/> • • • There should be no sound signals by the mark boats.	All races that have started are <i>abandoned</i> . Return to the starting area. We should be clear that the class flag (and fleet flag if applicable) should be displayed below
	<input type="checkbox"/> • • • There should be no sound signals by the mark boats.	All races are <i>abandoned</i> . Further signals ashore. Same comment about displaying the class flag and fleet flag (if applicable)

19 **Measuring the Wind**

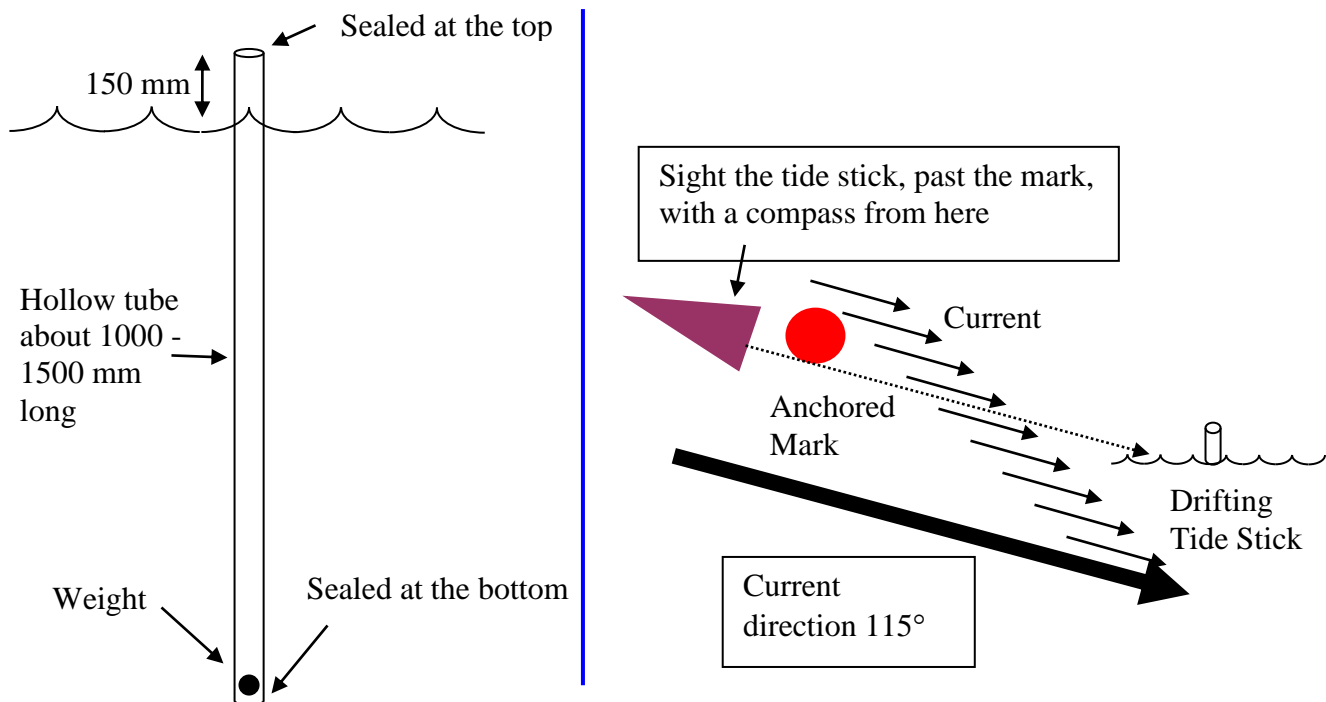
In a drifting boat:

1. At start minus one hour the wind reader observes the wind speed and direction.
2. The recorder writes the actual compass direction of the wind direction found at that time on the sheet (see section 25 Wind Graph paper) at the centre/top of the graph and on each side of this figure he/she adds or subtracts 5 degree increments.
3. It is best to have a wind reader and a recorder working together.
4. For the first half hour record the time, wind direction and speed. Mark on the graphs with a dot the speed and direction.
5. After the first half hour, connect the dots, which will give you a graph. Draw a coloured vertical line down the centre of all the direction dots which will give you an average wind direction for the first half hour.
6. At 55 minutes with a coloured marker draw another vertical line down the centre of the dots for the second half hour.
7. Repeat every half hour.

20 Measuring the Current

Tide Stick

A tide stick is a piece of hollow tube sealed at both ends so it is watertight. Just sufficient weight is added to one end so the top of the stick floats about 150 mm above the water.



To measure the current throw the tide stick next to an object that is anchored to the seabed. Time the movement of the stick. Use a hand bearing compass to measure the direction of movement by standing on station behind the stationary object and measure towards the tide stick.

Use a laser range finder to find, or estimate, the distance travelled over the time taken and use the formula below to calculate the speed of the current.

$$\text{Speed in Knots} = \frac{\text{Twice the distance in metres}}{\text{Time in seconds}}$$

Examples

(i) A stick is estimated to have moved 12 m (2 boat lengths) in 1 minute.

$$\begin{aligned}\text{Speed in Knots} &= 2 \times 12 \div 60 \\ &= 0.4 \text{ knot}\end{aligned}$$

(ii) A stick moved 135 m in 1 minute and 40 seconds. (Use range finder to measure the distance)

$$\begin{aligned}\text{Speed in Knots} &= 2 \times 135 \div 100 \\ &= 2.7 \text{ knots}\end{aligned}$$

When there is no stationary object but there is a strong current stop the boat and allow it to drift. Use the GPS to note any speed and direction over the seabed.

21 Using the GPS (Garmin 72 / 76)

Setup

General

- Mode Normal
- WAAS Disabled
- Backlight Time out 15 Seconds
- Beeper Key and Message
- Language English

Time

- Time Format 24 hour
- Time Zone Other UTC offset +13:00
- Daylight Saving Time
- Current Date
- Current Time

Location

- Location format hddd°mm.mmm'
- Map Datum WGS 84
- North Reference Magnetic
- Magnetic Variation

Alarms

all off

Interface

- Serial Data Format Garmin

Garmin GPSMap76 screens

- GPS Information Page Location & time
- Map Page
- Pointer Page
- Highway Page
- Active Route Page

Data Fields

- Menu – setup page layout Medium (1 Rows)
 - Change data fields
 - Highlight and enter
 - Top left BEARING
 - Top right DISTANCE TO NEXT

Creating Waypoints

- On GPS info page
- Press and hold ENTER
- This gives Mark Waypoint page
- It is the current position with a numeric label. Label and position can be changed using the ROCKER key.
-

Waypoints

- Select the waypoint
- MENU, MENU (gives main menu)
- Scroll to **Points**, then **waypoints**
- Press ENTER and Scroll to your waypoint name.
- Press ENTER rocker to GO TO – ENTER- PAGE to Pointer or Highway

22 Finding the Reference Position using the Garmin 72 / 76

This to be done by the Deputy Race Officer on board the Signal Boat.

Before going to sea create a waypoint named "REFERENCE"

Determine the Start line length and the table on page 8 to find:

- (i) the angle (A) to be subtracted from the course axis; and
- (ii) the distance (D) from the Signal Boat to the reference point.

When the course axis is determined by the Race Officer, subtract angle A from the course axis. This is the bearing from the Signal boat to the reference position.

On the GPS:

MENU

MENU

Scroll to Points

ENTER

Scroll to Waypoints

ENTER

Scroll to REFERENCE

ENTER

ENTER

You should now have the screen headed up Waypoint REFERENCE

MENU

Scroll to Project Location

ENTER

Scroll up to Distance

ENTER

Input the correct distance using the rocker bar

ENTER

Scroll down to Bearing

Input the correct angle (Course axis minus A) using the rocker bar

ENTER

Scroll down to Save

ENTER

This screen gives the correct Latitude and Longitude of the reference point. It can now be transmitted to the Mark boats.

Call signs.

The call sign for each mark boat relates to the mark assignment. Eg.

Mark Boat One is “Mark Boat One”

Mark Boat Two is “Mark Boat Two” etc.

The **Start Pin** boat call sign is “Start Pin”.

Signal Boat is “Signal Boat”

Finish Boat is “Finish Boat”

Finish Pin is “Finish Pin”

Procedure

State the call sign of the boat you are calling **first**, call this name twice when you start calling, then “this is” your call sign.

e.g.

“**Signal Boat, Signal Boat** this is **Mark Boat One**”

Wait for acknowledgement prior to sending your message. If none received, Repeat the call

Once acknowledged, send your message, speak slowly.

Keep the microphone out of the wind.

Speak across the face of the microphone not directly into it.

Take care not to have your mouth too close to the mike.

Do not shout.

Keep the message short and to the point.

The channel is used by the entire team and needs to be clear - use only to give messages about the racing.

Make sure no one else is speaking on the radio before sending a message.

When you have been given a message, acknowledge receipt, otherwise the sender is unaware of your understanding or hearing of the message.

Acknowledgement implies concurrence and a willingness to react to the message.

Sign off consists of

“Mark Boat One Out”

Always check your radio to see that it is not turned on. Sometimes the button used to send can be “ON” due to clothing or touching another object.

If you have not heard any talk on the radio for a while, check to see:

if your mike is stuck on

if your battery is dead

if you are on the correct channel.

if the squelch is fully on

Example

Signal Boat, Signal Boat this is **Mark Boat One**

Mark Boat One, this is Signal Boat go ahead

Signal Boat this is **Mark Boat One**. The wind direction is steady at 340 degrees and 5 knots. We have 0.4 knots of current from 270 degrees. **Mark Boat One** out.

Mark Boat One, this is **Signal Boat**: All copied. Thank you. **Signal Boat** Clear.

24 **Record of GPS Positions**

	Time	Latitude	Longitude		Comment
Reference Position					
Signal Boat					
Start Pin					
Mark 1					
Mark 2					
Mark 3					
Mark 4					
Finish Boat					
Finish Pin					
Reference Position					
Signal Boat					
Start Pin					
Mark 1					
Mark 2					
Mark 3					
Mark 4					
Finish Boat					
Finish Pin					
Reference Position					
Signal Boat					
Start Pin					
Mark 1					
Mark 2					
Mark 3					
Mark 4					
Finish Boat					
Finish Pin					

Recorders Name _____

Position _____

Date _____

Current			Time	Wind Speed (Knots)					Wind Direction								
Time	Speed	Direction		5	10	15	20	25	— — — — — — —								

	Average Direction	Average Velocity	Maximum velocity	Minimum Velocity
First half hour				
Second half hour				
Third half hour				
Fourth half hour				
Fifth half hour				
Sixth half hour				

26 Finishing Sheet

Race number	Class	Date
<input type="text"/>	<input type="text"/>	<input type="text"/>
Race area	Time of first boat	Time of last boat
<input type="text"/>	<input type="text"/>	<input type="text"/>
Start time	Position on course	Recorder
<input type="text"/>	<input type="text"/>	<input type="text"/>

1		29		57	
2		30		58	
3		31		69	
4		32		60	
5		33		61	
6		34		62	
7		35		63	
8		36		64	
9		37		65	
10		38		66	
11		39		67	
12		40		68	
13		41		69	
14		42		70	
15		43			OCS/DNF
16		44			
17		45			
18		46			
19		47			
20		48			
21		49			
22		50			
23		51			
24		52			
25		53			
26		54			
27		55			
28		56			

27 **Rounding Sheet**

Race number

Class

Date

Race area

Time of first boat

Time of last boat

Start time

Position on course

Recorder

1		26		51	
2		27		52	
3		28		53	
4		29		54	
5		30		55	
6		31		56	
7		32		57	
8		33		58	
9		34		59	
10		35		60	
11		36		61	
12		37		62	
13		38		63	
14		39		64	
15		40		65	
16		41		66	
17		42		67	
18		43		68	
19		44		69	
20		45		70	
21		46		71	
22		47		72	
23		48		73	
24		49		74	
25		50		75	

Please record all boats rounding your mark in sequential order. Record as many times as possible. Report to the RO when first and last round your mark as it happens.

Comments – unusual events

28 ***Wind Speed Recording Sheet for the Signal Boat***

Time	Mark 1		Mark 2		Mark 3		Mark 4		Finish		Start Pin		Signal Boat	
	Speed	Direction	Speed	Direction	Speed	Direction	Speed	Direction	Speed	Direction	Speed	Direction	Speed	Direction

29 Trapezoid Course 70°, 110° interior angles

Mark 1 Bearing to Reference = Course Axis ± 180°

Course Axis	Trapezoid Course 70, 110 interior angles								
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
000	180	321	141	250	070	270	090	110	290
005	185	326	146	255	075	275	095	115	295
010	190	331	151	260	080	280	100	120	300
015	195	336	156	265	085	285	105	125	305
020	200	341	161	270	090	290	110	130	310
025	205	346	166	275	095	295	115	135	315
030	210	351	171	280	100	300	120	140	320
035	215	356	176	285	105	305	125	145	325
040	220	001	181	290	110	310	130	150	330
045	225	006	186	295	115	315	135	155	335
050	230	011	191	300	120	320	140	160	340
055	235	016	196	305	125	325	145	165	345
060	240	021	201	310	130	330	150	170	350
065	245	026	206	315	135	335	155	175	355
070	250	031	211	320	140	340	160	180	000
075	255	036	216	325	145	345	165	185	005
080	260	041	221	330	150	350	170	190	010
085	265	046	226	335	155	355	175	195	015
090	270	051	231	340	160	000	180	200	020
095	275	056	236	345	165	005	185	205	025
100	280	061	241	350	170	010	190	210	030
105	285	066	246	355	175	015	195	215	035
110	290	071	251	000	180	020	200	220	040
115	295	076	256	005	185	025	205	225	045
120	300	081	261	010	190	030	210	230	050
125	305	086	266	015	195	035	215	235	055
130	310	091	271	020	200	040	220	240	060
135	315	096	276	025	205	045	225	245	065
140	320	101	281	030	210	050	230	250	070
145	325	106	286	035	215	055	235	255	075
150	330	111	291	040	220	060	240	260	080
155	335	116	296	045	225	065	245	265	085
160	340	121	301	050	230	070	250	270	090
165	345	126	306	055	235	075	255	275	095
170	350	131	311	060	240	080	260	280	100
175	355	136	316	065	245	085	265	285	105

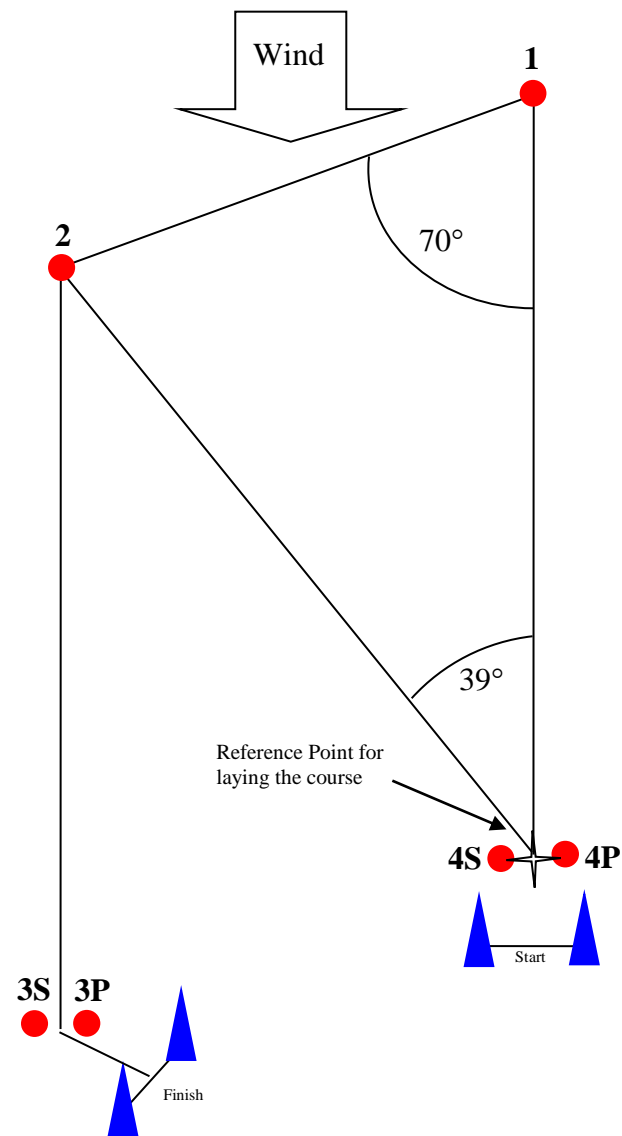
Course Axis									
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	360	141	321	070	250	090	270	290	110
185	005	146	326	075	255	095	275	295	115
190	010	151	331	080	260	100	280	300	120
195	015	156	336	085	265	105	285	305	125
200	020	161	341	090	270	110	290	310	130
205	025	166	346	095	275	115	295	315	135
210	030	171	351	100	280	120	300	320	140
215	035	176	356	105	285	125	305	325	145
220	040	181	001	110	290	130	310	330	150
225	045	186	006	115	295	135	315	335	155
230	050	191	011	120	300	140	320	340	160
235	055	196	016	125	305	145	325	345	165
240	060	201	021	130	310	150	330	350	170
245	065	206	026	135	315	155	335	355	175
250	070	211	031	140	320	160	340	000	180
255	075	216	036	145	325	165	345	005	185
260	080	221	041	150	330	170	350	010	190
265	085	226	046	155	335	175	355	015	195
270	090	231	051	160	340	180	000	020	200
275	095	236	056	165	345	185	005	025	205
280	100	241	061	170	350	190	010	030	210
285	105	246	066	175	355	195	015	035	215
290	110	251	071	180	000	200	020	040	220
295	115	256	076	185	005	205	025	045	225
300	120	261	081	190	010	210	030	050	230
305	125	266	086	195	015	215	035	055	235
310	130	271	091	200	020	220	040	060	240
315	135	276	096	205	025	225	045	065	245
320	140	281	101	210	030	230	050	070	250
325	145	286	106	215	035	235	055	075	255
330	150	291	111	220	040	240	060	080	260
335	155	296	116	225	045	245	065	085	265
340	160	301	121	230	050	250	070	090	270
345	165	306	126	235	055	255	075	095	275
350	170	311	131	240	060	260	080	100	280
355	175	316	136	245	065	265	085	105	285

70° Trapezoid Course Lengths to Marks and Course Lengths – Equal beats 1-2 two thirds of beat length
Start 0.05 nt mi downwind of 4S/4P(4) and Finish 0.15 nt mi from 3S/3P(3)

Leg lengths		
4 - 1 & 1 - 4	4 - 2 & 2 - 4	1 - 2 & 2 - 1
2 - 3 & 3 - 2		4 - 3 & 3 - 4
0.20	0.20	0.13
0.25	0.25	0.17
0.30	0.30	0.20
0.35	0.35	0.23
0.40	0.40	0.27
0.45	0.45	0.30
0.50	0.50	0.33
0.55	0.55	0.37
0.60	0.60	0.40
0.65	0.65	0.43
0.70	0.70	0.47
0.75	0.75	0.50
0.80	0.80	0.53
0.85	0.85	0.57
0.90	0.89	0.60
0.95	0.94	0.63
1.00	0.99	0.67
1.10	1.09	0.73
1.20	1.19	0.80
1.30	1.29	0.87
1.40	1.39	0.93
1.50	1.49	1.00
1.60	1.59	1.07
1.70	1.69	1.13
1.80	1.79	1.20
1.90	1.89	1.27
2.00	1.99	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.60	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.20	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53

- I2** Start – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I3** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I4** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- O2** Start – 1 – 2 – 3S/3P – 2 – 3P – Finish
- O3** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish
- O4** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish



30 Trapezoid Course 60°, 120° interior angles

Mark 1 Bearing to Reference = Course Axis ±180°

Course Axis	Trapezoid Course 60, 120 interior angles								
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
000	180	319	139	240	060	270	090	120	300
005	185	324	144	245	065	275	095	125	305
010	190	329	149	250	070	280	100	130	310
015	195	334	154	255	075	285	105	135	315
020	200	339	159	260	080	290	110	140	320
025	205	344	164	265	085	295	115	145	325
030	210	349	169	270	090	300	120	150	330
035	215	354	174	275	095	305	125	155	335
040	220	359	179	280	100	310	130	160	340
045	225	004	184	285	105	315	135	165	345
050	230	009	189	290	110	320	140	170	350
055	235	014	194	295	115	325	145	175	355
060	240	019	199	300	120	330	150	180	000
065	245	024	204	305	125	335	155	185	005
070	250	029	209	310	130	340	160	190	010
075	255	034	214	315	135	345	165	195	015
080	260	039	219	320	140	350	170	200	020
085	265	044	224	325	145	355	175	205	025
090	270	049	229	330	150	000	180	210	030
095	275	054	234	335	155	005	185	215	035
100	280	059	239	340	160	010	190	220	040
105	285	064	244	345	165	015	195	225	045
110	290	069	249	350	170	020	200	230	050
115	295	074	254	355	175	025	205	235	055
120	300	079	259	000	180	030	210	240	060
125	305	084	264	005	185	035	215	245	065
130	310	089	269	010	190	040	220	250	070
135	315	094	274	015	195	045	225	255	075
140	320	099	279	020	200	050	230	260	080
145	325	104	284	025	205	055	235	265	085
150	330	109	289	030	210	060	240	270	090
155	335	114	294	035	215	065	245	275	095
160	340	119	299	040	220	070	250	280	100
165	345	124	304	045	225	075	255	285	105
170	350	129	309	050	230	080	260	290	110
175	355	134	314	055	235	085	265	295	115

Course Axis									
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	000	139	319	060	240	090	270	300	120
185	005	144	324	065	245	095	275	305	125
190	010	149	329	070	250	100	280	310	130
195	015	154	334	075	255	105	285	315	135
200	020	159	339	080	260	110	290	320	140
205	025	164	344	085	265	115	295	325	145
210	030	169	349	090	270	120	300	330	150
215	035	174	354	095	275	125	305	335	155
220	040	179	359	100	280	130	310	340	160
225	045	184	004	105	285	135	315	345	165
230	050	189	009	110	290	140	320	350	170
235	055	194	014	115	295	145	325	355	175
240	060	199	019	120	300	150	330	000	180
245	065	204	024	125	305	155	335	005	185
250	070	209	029	130	310	160	340	010	190
255	075	214	034	135	315	165	345	015	195
260	080	219	039	140	320	170	350	020	200
265	085	224	044	145	325	175	355	025	205
270	090	229	049	150	330	180	000	030	210
275	095	234	054	155	335	185	005	035	215
280	100	239	059	160	340	190	010	040	220
285	105	244	064	165	345	195	015	045	225
290	110	249	069	170	350	200	020	050	230
295	115	254	074	175	355	205	025	055	235
300	120	259	079	180	000	210	030	060	240
305	125	264	084	185	005	215	035	065	245
310	130	269	089	190	010	220	040	070	250
315	135	274	094	195	015	225	045	075	255
320	140	279	099	200	020	230	050	080	260
325	145	284	104	205	025	235	055	085	265
330	150	289	109	210	030	240	060	090	270
335	155	294	114	215	035	245	065	095	275
340	160	299	119	220	040	250	070	100	280
345	165	304	124	225	045	255	075	105	285
350	170	309	129	230	050	260	080	110	290
355	175	314	134	235	055	265	085	115	295

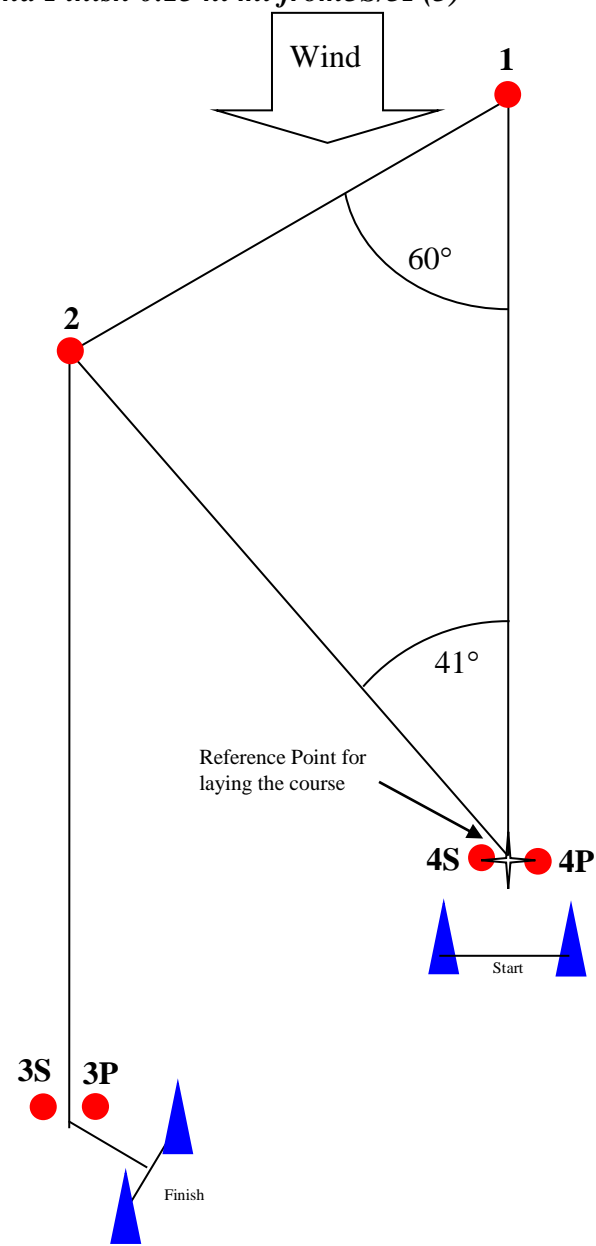
60° Trapezoid Course Lengths to Marks and Course Lengths – Equal beats 1-2 two thirds of beat length

Start 0.05 nt mi downwind of 4S/4P(4) and Finish 0.15 nt mi from 3S/3P(3)

Leg lengths		
4 - 1 & 1 - 4	4 - 2 &	1 - 2 & 2 - 1
2 - 3 & 3 - 2	2 - 4	4 - 3 & 3 - 4
0.20	0.18	0.13
0.25	0.22	0.17
0.30	0.26	0.20
0.35	0.31	0.23
0.40	0.35	0.27
0.45	0.40	0.30
0.50	0.44	0.33
0.55	0.48	0.37
0.60	0.53	0.40
0.65	0.57	0.43
0.70	0.62	0.47
0.75	0.66	0.50
0.80	0.70	0.53
0.85	0.75	0.57
0.90	0.79	0.60
0.95	0.84	0.63
1.00	0.88	0.67
1.10	0.97	0.73
1.20	1.06	0.80
1.30	1.14	0.87
1.40	1.23	0.93
1.50	1.32	1.00
1.60	1.41	1.07
1.70	1.50	1.13
1.80	1.58	1.20
1.90	1.67	1.27
2.00	1.76	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.06	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.2	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53

- I2** Start – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I3** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I4** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- O2** Start – 1 – 2 – 3S/3P – 2 – 3P – Finish
- O3** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish
- O4** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish



31 *Windward-leeward courses with 80° offset mark 1A*

Course Axis					
4 - 1A	1A - 4	1 - 1A	1A - 1	Signal - Pin	Pin - Signal
000	180	280	100	270	090
005	185	285	105	275	095
010	190	290	110	280	100
015	195	295	115	285	105
020	200	300	120	290	110
025	205	305	125	295	115
030	210	310	130	300	120
035	215	315	135	305	125
040	220	320	140	310	130
045	225	325	145	315	135
050	230	330	150	320	140
055	235	335	155	325	145
060	240	340	160	330	150
065	245	345	165	335	155
070	250	350	170	340	160
075	255	355	175	345	165
080	260	000	180	350	170
085	265	005	185	355	175
090	270	010	190	000	180
095	275	015	195	005	185
100	280	020	200	010	190
105	285	025	205	015	195
110	290	030	210	020	200
115	295	035	215	025	205
120	300	040	220	030	210
125	305	045	225	035	215
130	310	050	230	040	220
135	315	055	235	045	225
140	320	060	240	050	230
145	325	065	245	055	235
150	330	070	250	060	240
155	335	075	255	065	245
160	340	080	260	070	250
165	345	085	265	075	255
170	350	090	270	080	260
175	355	095	275	085	265

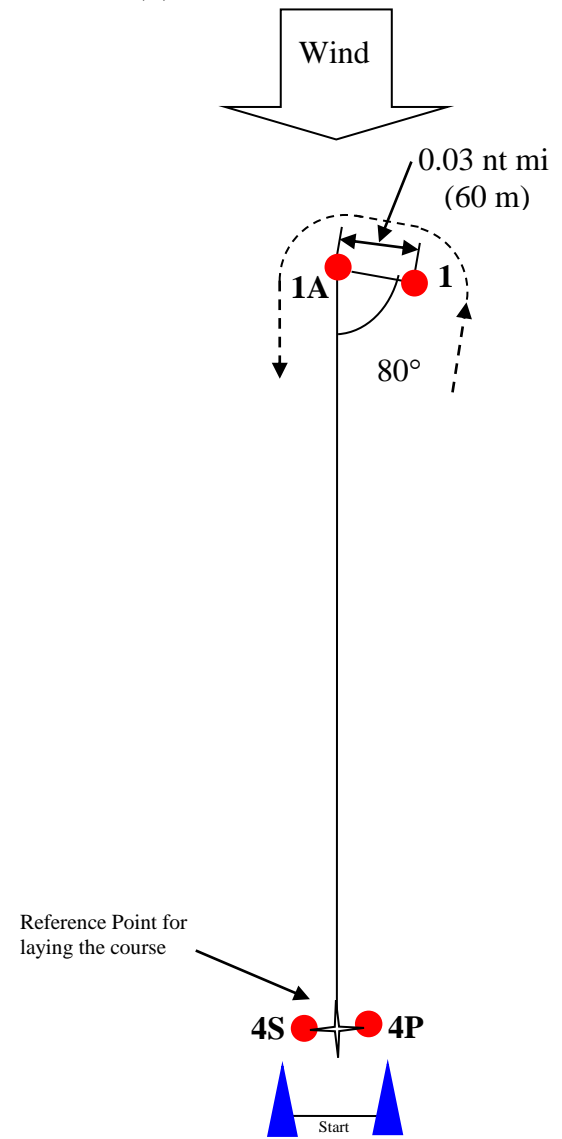
Course Axis					
4 - 1A	1A - 4	1 - 1A	1A - 1	Signal - Pin	Pin - Signal
180	000	100	280	090	270
185	005	105	285	095	275
190	010	110	290	100	280
195	015	115	295	105	285
200	020	120	300	110	290
205	025	125	305	115	295
210	030	130	310	120	300
215	035	135	315	125	305
220	040	140	320	130	310
225	045	145	325	135	315
230	050	150	330	140	320
235	055	155	335	145	325
240	060	160	340	150	330
245	065	165	345	155	335
250	070	170	350	160	340
255	075	175	355	165	345
260	080	180	000	170	350
265	085	185	005	175	355
270	090	190	010	180	000
275	095	195	015	185	005
280	100	200	020	190	010
285	105	205	025	195	015
290	110	210	030	200	020
295	115	215	035	205	025
300	120	220	040	210	030
305	125	225	045	215	035
310	130	230	050	220	040
315	135	235	055	225	045
320	140	240	060	230	050
325	145	245	065	235	055
330	150	250	070	240	060
335	155	255	075	245	065
340	160	260	080	250	070
345	165	265	085	255	075
350	170	270	090	260	080
355	175	275	095	265	085

Windward-leeward Course Lengths to Marks and Course Lengths
Start/Finish 0.05 nt mi downwind of mark 4S/4P (4)

Leg lengths	
4 - 1	1 - 1A
1 - 4	1A - 1
0.50	0.02
0.60	0.02
0.70	0.02
0.80	0.02
0.90	0.02
1.00	0.02
1.10	0.02
1.20	0.02
1.30	0.02
1.40	0.02
1.50	0.02
1.60	0.02
1.70	0.02
1.80	0.02
1.90	0.02
2.00	0.02
2.10	0.02
2.20	0.02
2.30	0.02
2.40	0.02
2.50	0.02
2.60	0.02
2.70	0.02
2.80	0.02
2.90	0.02
3.00	0.02

Course Distances			
L1	L2	L3	L4
1.13	2.16	3.19	4.22
1.33	2.56	3.79	5.02
1.53	2.96	4.39	5.82
1.73	3.36	4.99	6.62
1.93	3.76	5.59	7.42
2.13	4.16	6.19	8.22
2.33	4.56	6.79	9.02
2.53	4.96	7.39	9.82
2.73	5.36	7.99	10.62
2.93	5.76	8.59	11.42
3.13	6.16	9.19	12.22
3.33	6.56	9.79	13.02
3.53	6.96	10.39	13.82
3.73	7.36	10.99	14.62
3.93	7.76	11.59	15.42
4.13	8.16	12.19	16.22
4.33	8.56	12.79	17.02
4.53	8.96	13.39	17.82
4.73	9.36	13.99	18.62
4.93	9.76	14.59	19.42
5.13	10.16	15.19	20.22
5.33	10.56	15.79	21.02
5.53	10.96	16.39	21.82
5.73	11.36	16.99	22.62
5.93	11.76	17.59	23.42
6.13	12.16	18.19	24.22

L2 Start – 1 – 4S/4P – 1 – Finish
L3 Start – 1 – 4S/4P – 1 – 4S/4P – 1 – Finish
L4 Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – Finish



32 Trapezoid Course 70°, 110° interior angles

Mark 2 Bearing to Reference = Course Axis + 141°

Course Axis	Trapezoid Course 70, 110 interior angles								
4 - 1	1 - 4		2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
000	180	321	141	250	070	270	090	110	290
005	185	326	146	255	075	275	095	115	295
010	190	331	151	260	080	280	100	120	300
015	195	336	156	265	085	285	105	125	305
020	200	341	161	270	090	290	110	130	310
025	205	346	166	275	095	295	115	135	315
030	210	351	171	280	100	300	120	140	320
035	215	356	176	285	105	305	125	145	325
040	220	001	181	290	110	310	130	150	330
045	225	006	186	295	115	315	135	155	335
050	230	011	191	300	120	320	140	160	340
055	235	016	196	305	125	325	145	165	345
060	240	021	201	310	130	330	150	170	350
065	245	026	206	315	135	335	155	175	355
070	250	031	211	320	140	340	160	180	000
075	255	036	216	325	145	345	165	185	005
080	260	041	221	330	150	350	170	190	010
085	265	046	226	335	155	355	175	195	015
090	270	051	231	340	160	000	180	200	020
095	275	056	236	345	165	005	185	205	025
100	280	061	241	350	170	010	190	210	030
105	285	066	246	355	175	015	195	215	035
110	290	071	251	000	180	020	200	220	040
115	295	076	256	005	185	025	205	225	045
120	300	081	261	010	190	030	210	230	050
125	305	086	266	015	195	035	215	235	055
130	310	091	271	020	200	040	220	240	060
135	315	096	276	025	205	045	225	245	065
140	320	101	281	030	210	050	230	250	070
145	325	106	286	035	215	055	235	255	075
150	330	111	291	040	220	060	240	260	080
155	335	116	296	045	225	065	245	265	085
160	340	121	301	050	230	070	250	270	090
165	345	126	306	055	235	075	255	275	095
170	350	131	311	060	240	080	260	280	100
175	355	136	316	065	245	085	265	285	105

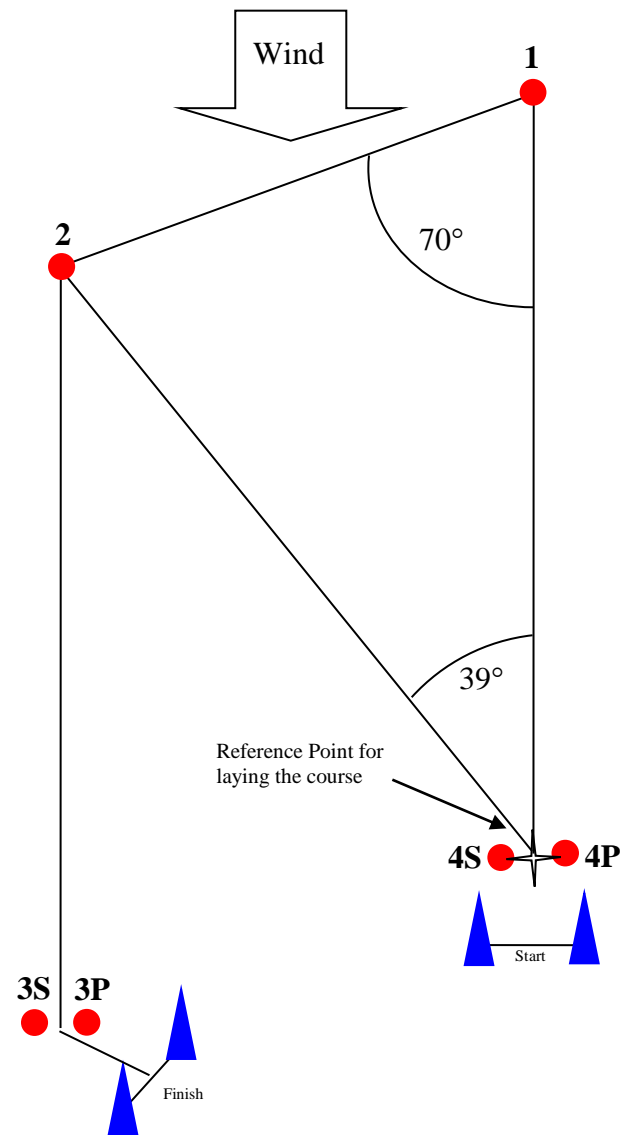
Course Axis									
4 - 1	1 - 4		2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	360	141	321	070	250	090	270	290	110
185	005	146	326	075	255	095	275	295	115
190	010	151	331	080	260	100	280	300	120
195	015	156	336	085	265	105	285	305	125
200	020	161	341	090	270	110	290	310	130
205	025	166	346	095	275	115	295	315	135
210	030	171	351	100	280	120	300	320	140
215	035	176	356	105	285	125	305	325	145
220	040	181	001	110	290	130	310	330	150
225	045	186	006	115	295	135	315	335	155
230	050	191	011	120	300	140	320	340	160
235	055	196	016	125	305	145	325	345	165
240	060	201	021	130	310	150	330	350	170
245	065	206	026	135	315	155	335	355	175
250	070	211	031	140	320	160	340	000	180
255	075	216	036	145	325	165	345	005	185
260	080	221	041	150	330	170	350	010	190
265	085	226	046	155	335	175	355	015	195
270	090	231	051	160	340	180	000	020	200
275	095	236	056	165	345	185	005	025	205
280	100	241	061	170	350	190	010	030	210
285	105	246	066	175	355	195	015	035	215
290	110	251	071	180	000	200	020	040	220
295	115	256	076	185	005	205	025	045	225
300	120	261	081	190	010	210	030	050	230
305	125	266	086	195	015	215	035	055	235
310	130	271	091	200	020	220	040	060	240
315	135	276	096	205	025	225	045	065	245
320	140	281	101	210	030	230	050	070	250
325	145	286	106	215	035	235	055	075	255
330	150	291	111	220	040	240	060	080	260
335	155	296	116	225	045	245	065	085	265
340	160	301	121	230	050	250	070	090	270
345	165	306	126	235	055	255	075	095	275
350	170	311	131	240	060	260	080	100	280
355	175	316	136	245	065	265	085	105	285

**70° Trapezoid Course Lengths to Marks and Course Lengths – Equal beats 1-2 two thirds of beat length
Start 0.05 nt mi downwind of 4S/4P(4) and Finish 0.15 nt mi from 3S/3P(3)**

Leg lengths		
4 - 1 & 1 - 4	4 - 2 & 2 - 4	1 - 2 & 2 - 1
2 - 3 & 3 - 2	4 - 2 & 2 - 4	4 - 3 & 3 - 4
0.20	0.20	0.13
0.25	0.25	0.17
0.30	0.30	0.20
0.35	0.35	0.23
0.40	0.40	0.27
0.45	0.45	0.30
0.50	0.50	0.33
0.55	0.55	0.37
0.60	0.60	0.40
0.65	0.65	0.43
0.70	0.70	0.47
0.75	0.75	0.50
0.80	0.80	0.53
0.85	0.85	0.57
0.90	0.89	0.60
0.95	0.94	0.63
1.00	0.99	0.67
1.10	1.09	0.73
1.20	1.19	0.80
1.30	1.29	0.87
1.40	1.39	0.93
1.50	1.49	1.00
1.60	1.59	1.07
1.70	1.69	1.13
1.80	1.79	1.20
1.90	1.89	1.27
2.00	1.99	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.60	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.20	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53

- I2** Start – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I3** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I4** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- O2** Start – 1 – 2 – 3S/3P – 2 – 3P – Finish
- O3** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish
- O4** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish



33 Trapezoid Course 60°, 120° interior angles

Mark 2 Bearing to Reference = Course Axis + 139°

Course Axis	Trapezoid Course 60, 120 interior angles								
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
000	180	319	139	240	060	270	090	120	300
005	185	324	144	245	065	275	095	125	305
010	190	329	149	250	070	280	100	130	310
015	195	334	154	255	075	285	105	135	315
020	200	339	159	260	080	290	110	140	320
025	205	344	164	265	085	295	115	145	325
030	210	349	169	270	090	300	120	150	330
035	215	354	174	275	095	305	125	155	335
040	220	359	179	280	100	310	130	160	340
045	225	004	184	285	105	315	135	165	345
050	230	009	189	290	110	320	140	170	350
055	235	014	194	295	115	325	145	175	355
060	240	019	199	300	120	330	150	180	000
065	245	024	204	305	125	335	155	185	005
070	250	029	209	310	130	340	160	190	010
075	255	034	214	315	135	345	165	195	015
080	260	039	219	320	140	350	170	200	020
085	265	044	224	325	145	355	175	205	025
090	270	049	229	330	150	000	180	210	030
095	275	054	234	335	155	005	185	215	035
100	280	059	239	340	160	010	190	220	040
105	285	064	244	345	165	015	195	225	045
110	290	069	249	350	170	020	200	230	050
115	295	074	254	355	175	025	205	235	055
120	300	079	259	000	180	030	210	240	060
125	305	084	264	005	185	035	215	245	065
130	310	089	269	010	190	040	220	250	070
135	315	094	274	015	195	045	225	255	075
140	320	099	279	020	200	050	230	260	080
145	325	104	284	025	205	055	235	265	085
150	330	109	289	030	210	060	240	270	090
155	335	114	294	035	215	065	245	275	095
160	340	119	299	040	220	070	250	280	100
165	345	124	304	045	225	075	255	285	105
170	350	129	309	050	230	080	260	290	110
175	355	134	314	055	235	085	265	295	115

Course Axis									
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	000	139	319	060	240	090	270	300	120
185	005	144	324	065	245	095	275	305	125
190	010	149	329	070	250	100	280	310	130
195	015	154	334	075	255	105	285	315	135
200	020	159	339	080	260	110	290	320	140
205	025	164	344	085	265	115	295	325	145
210	030	169	349	090	270	120	300	330	150
215	035	174	354	095	275	125	305	335	155
220	040	179	359	100	280	130	310	340	160
225	045	184	004	105	285	135	315	345	165
230	050	189	009	110	290	140	320	350	170
235	055	194	014	115	295	145	325	355	175
240	060	199	019	120	300	150	330	000	180
245	065	204	024	125	305	155	335	005	185
250	070	209	029	130	310	160	340	010	190
255	075	214	034	135	315	165	345	015	195
260	080	219	039	140	320	170	350	020	200
265	085	224	044	145	325	175	355	025	205
270	090	229	049	150	330	180	000	030	210
275	095	234	054	155	335	185	005	035	215
280	100	239	059	160	340	190	010	040	220
285	105	244	064	165	345	195	015	045	225
290	110	249	069	170	350	200	020	050	230
295	115	254	074	175	355	205	025	055	235
300	120	259	079	180	000	210	030	060	240
305	125	264	084	185	005	215	035	065	245
310	130	269	089	190	010	220	040	070	250
315	135	274	094	195	015	225	045	075	255
320	140	279	099	200	020	230	050	080	260
325	145	284	104	205	025	235	055	085	265
330	150	289	109	210	030	240	060	090	270
335	155	294	114	215	035	245	065	095	275
340	160	299	119	220	040	250	070	100	280
345	165	304	124	225	045	255	075	105	285
350	170	309	129	230	050	260	080	110	290
355	175	314	134	235	055	265	085	115	295

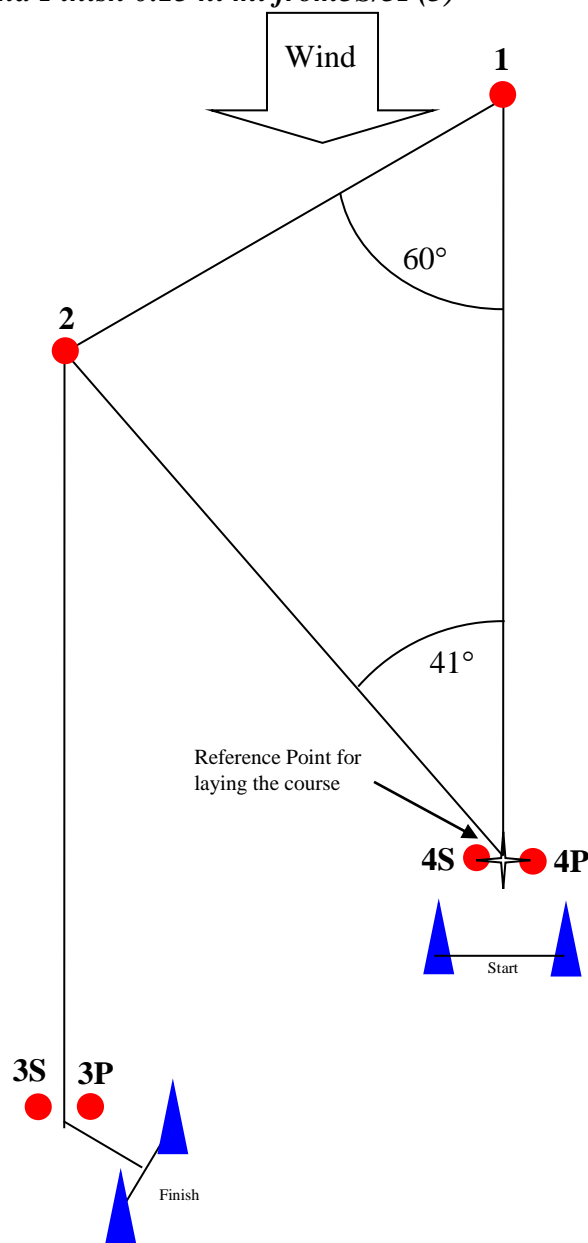
60° Trapezoid Course Lengths to Marks and Course Lengths – Equal beats 1-2 two thirds of beat length

Start 0.05 nt mi downwind of 4S/4P(4) and Finish 0.15 nt mi from 3S/3P(3)

Leg lengths		
4 - 1 & 1 - 4	4 - 2	1 - 2 & 2 - 1
2 - 3 & 3 - 2	& 2 - 4	4 - 3 & 3 - 4
0.20	0.18	0.13
0.25	0.22	0.17
0.30	0.26	0.20
0.35	0.31	0.23
0.40	0.35	0.27
0.45	0.40	0.30
0.50	0.44	0.33
0.55	0.48	0.37
0.60	0.53	0.40
0.65	0.57	0.43
0.70	0.62	0.47
0.75	0.66	0.50
0.80	0.70	0.53
0.85	0.75	0.57
0.90	0.79	0.60
0.95	0.84	0.63
1.00	0.88	0.67
1.10	0.97	0.73
1.20	1.06	0.80
1.30	1.14	0.87
1.40	1.23	0.93
1.50	1.32	1.00
1.60	1.41	1.07
1.70	1.50	1.13
1.80	1.58	1.20
1.90	1.67	1.27
2.00	1.76	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.06	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.2	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53

- I2** Start – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I3** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I4** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- O2** Start – 1 – 2 – 3S/3P – 2 – 3P – Finish
- O3** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish
- O4** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish



34 Trapezoid Course 70°, 110° interior angles

Mark 3 Bearing to Reference = Course Axis + 70°

Course Axis	Trapezoid Course 70, 110 interior angles								
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
000	180	321	141	250	070	270	090	110	290
005	185	326	146	255	075	275	095	115	295
010	190	331	151	260	080	280	100	120	300
015	195	336	156	265	085	285	105	125	305
020	200	341	161	270	090	290	110	130	310
025	205	346	166	275	095	295	115	135	315
030	210	351	171	280	100	300	120	140	320
035	215	356	176	285	105	305	125	145	325
040	220	001	181	290	110	310	130	150	330
045	225	006	186	295	115	315	135	155	335
050	230	011	191	300	120	320	140	160	340
055	235	016	196	305	125	325	145	165	345
060	240	021	201	310	130	330	150	170	350
065	245	026	206	315	135	335	155	175	355
070	250	031	211	320	140	340	160	180	000
075	255	036	216	325	145	345	165	185	005
080	260	041	221	330	150	350	170	190	010
085	265	046	226	335	155	355	175	195	015
090	270	051	231	340	160	000	180	200	020
095	275	056	236	345	165	005	185	205	025
100	280	061	241	350	170	010	190	210	030
105	285	066	246	355	175	015	195	215	035
110	290	071	251	000	180	020	200	220	040
115	295	076	256	005	185	025	205	225	045
120	300	081	261	010	190	030	210	230	050
125	305	086	266	015	195	035	215	235	055
130	310	091	271	020	200	040	220	240	060
135	315	096	276	025	205	045	225	245	065
140	320	101	281	030	210	050	230	250	070
145	325	106	286	035	215	055	235	255	075
150	330	111	291	040	220	060	240	260	080
155	335	116	296	045	225	065	245	265	085
160	340	121	301	050	230	070	250	270	090
165	345	126	306	055	235	075	255	275	095
170	350	131	311	060	240	080	260	280	100
175	355	136	316	065	245	085	265	285	105

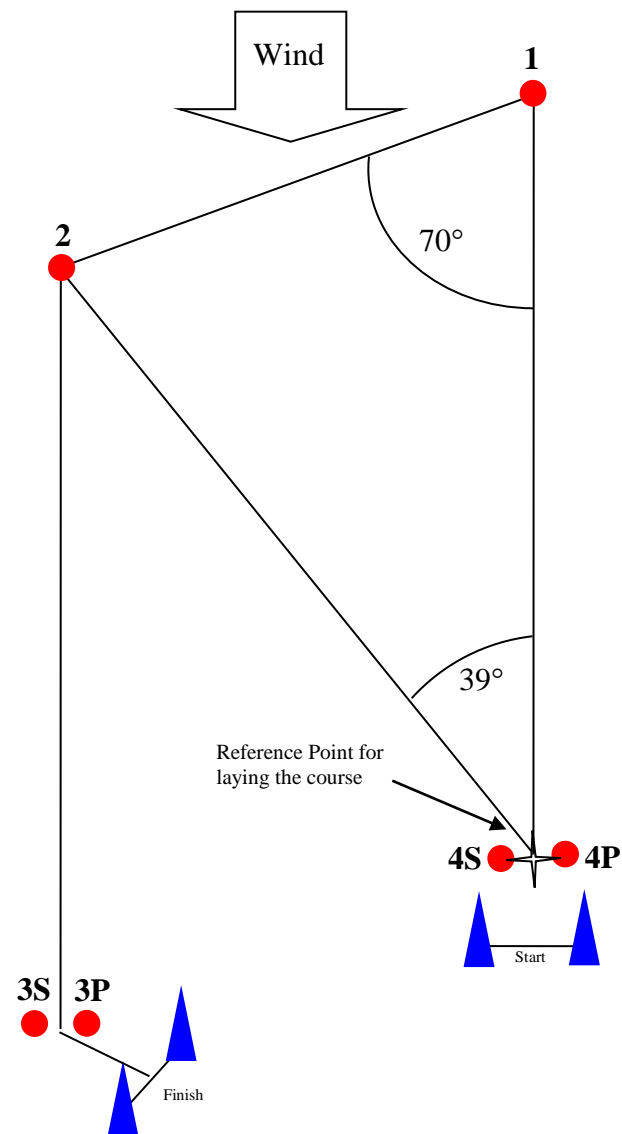
Course Axis									
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	360	141	321	070	250	090	270	290	110
185	005	146	326	075	255	095	275	295	115
190	010	151	331	080	260	100	280	300	120
195	015	156	336	085	265	105	285	305	125
200	020	161	341	090	270	110	290	310	130
205	025	166	346	095	275	115	295	315	135
210	030	171	351	100	280	120	300	320	140
215	035	176	356	105	285	125	305	325	145
220	040	181	001	110	290	130	310	330	150
225	045	186	006	115	295	135	315	335	155
230	050	191	011	120	300	140	320	340	160
235	055	196	016	125	305	145	325	345	165
240	060	201	021	130	310	150	330	350	170
245	065	206	026	135	315	155	335	355	175
250	070	211	031	140	320	160	340	000	180
255	075	216	036	145	325	165	345	005	185
260	080	221	041	150	330	170	350	010	190
265	085	226	046	155	335	175	355	015	195
270	090	231	051	160	340	180	000	020	200
275	095	236	056	165	345	185	005	025	205
280	100	241	061	170	350	190	010	030	210
285	105	246	066	175	355	195	015	035	215
290	110	251	071	180	000	200	020	040	220
295	115	256	076	185	005	205	025	045	225
300	120	261	081	190	010	210	030	050	230
305	125	266	086	195	015	215	035	055	235
310	130	271	091	200	020	220	040	060	240
315	135	276	096	205	025	225	045	065	245
320	140	281	101	210	030	230	050	070	250
325	145	286	106	215	035	235	055	075	255
330	150	291	111	220	040	240	060	080	260
335	155	296	116	225	045	245	065	085	265
340	160	301	121	230	050	250	070	090	270
345	165	306	126	235	055	255	075	095	275
350	170	311	131	240	060	260	080	100	280
355	175	316	136	245	065	265	085	105	285

**70° Trapezoid Course Lengths to Marks and Course Lengths – Equal beats 1-2 two thirds of beat length
Start 0.05 nt mi downwind of 4S/4P(4) and Finish 0.15 nt mi from 3S/3P(3)**

Leg lengths		
4 - 1 & 1 - 4	4 - 2 & 2 - 4	1 - 2 & 2 - 1
2 - 3 & 3 - 2	4 - 2 & 2 - 4	4 - 3 & 3 - 4
0.20	0.20	0.13
0.25	0.25	0.17
0.30	0.30	0.20
0.35	0.35	0.23
0.40	0.40	0.27
0.45	0.45	0.30
0.50	0.50	0.33
0.55	0.55	0.37
0.60	0.60	0.40
0.65	0.65	0.43
0.70	0.70	0.47
0.75	0.75	0.50
0.80	0.80	0.53
0.85	0.85	0.57
0.90	0.89	0.60
0.95	0.94	0.63
1.00	0.99	0.67
1.10	1.09	0.73
1.20	1.19	0.80
1.30	1.29	0.87
1.40	1.39	0.93
1.50	1.49	1.00
1.60	1.59	1.07
1.70	1.69	1.13
1.80	1.79	1.20
1.90	1.89	1.27
2.00	1.99	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.60	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.20	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53

- I2** Start – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I3** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I4** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- O2** Start – 1 – 2 – 3S/3P – 2 – 3P – Finish
- O3** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish
- O4** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish



35 Trapezoid Course 60°, 120° interior angles

Mark 3 Bearing to Reference = Course Axis + 60°

Course Axis	Trapezoid Course 60, 120 interior angles								
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
000	180	319	139	240	060	270	090	120	300
005	185	324	144	245	065	275	095	125	305
010	190	329	149	250	070	280	100	130	310
015	195	334	154	255	075	285	105	135	315
020	200	339	159	260	080	290	110	140	320
025	205	344	164	265	085	295	115	145	325
030	210	349	169	270	090	300	120	150	330
035	215	354	174	275	095	305	125	155	335
040	220	359	179	280	100	310	130	160	340
045	225	004	184	285	105	315	135	165	345
050	230	009	189	290	110	320	140	170	350
055	235	014	194	295	115	325	145	175	355
060	240	019	199	300	120	330	150	180	000
065	245	024	204	305	125	335	155	185	005
070	250	029	209	310	130	340	160	190	010
075	255	034	214	315	135	345	165	195	015
080	260	039	219	320	140	350	170	200	020
085	265	044	224	325	145	355	175	205	025
090	270	049	229	330	150	000	180	210	030
095	275	054	234	335	155	005	185	215	035
100	280	059	239	340	160	010	190	220	040
105	285	064	244	345	165	015	195	225	045
110	290	069	249	350	170	020	200	230	050
115	295	074	254	355	175	025	205	235	055
120	300	079	259	000	180	030	210	240	060
125	305	084	264	005	185	035	215	245	065
130	310	089	269	010	190	040	220	250	070
135	315	094	274	015	195	045	225	255	075
140	320	099	279	020	200	050	230	260	080
145	325	104	284	025	205	055	235	265	085
150	330	109	289	030	210	060	240	270	090
155	335	114	294	035	215	065	245	275	095
160	340	119	299	040	220	070	250	280	100
165	345	124	304	045	225	075	255	285	105
170	350	129	309	050	230	080	260	290	110
175	355	134	314	055	235	085	265	295	115

Course Axis									
4 - 1	1 - 4			4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	000	139	319	060	240	090	270	300	120
185	005	144	324	065	245	095	275	305	125
190	010	149	329	070	250	100	280	310	130
195	015	154	334	075	255	105	285	315	135
200	020	159	339	080	260	110	290	320	140
205	025	164	344	085	265	115	295	325	145
210	030	169	349	090	270	120	300	330	150
215	035	174	354	095	275	125	305	335	155
220	040	179	359	100	280	130	310	340	160
225	045	184	004	105	285	135	315	345	165
230	050	189	009	110	290	140	320	350	170
235	055	194	014	115	295	145	325	355	175
240	060	199	019	120	300	150	330	000	180
245	065	204	024	125	305	155	335	005	185
250	070	209	029	130	310	160	340	010	190
255	075	214	034	135	315	165	345	015	195
260	080	219	039	140	320	170	350	020	200
265	085	224	044	145	325	175	355	025	205
270	090	229	049	150	330	180	000	030	210
275	095	234	054	155	335	185	005	035	215
280	100	239	059	160	340	190	010	040	220
285	105	244	064	165	345	195	015	045	225
290	110	249	069	170	350	200	020	050	230
295	115	254	074	175	355	205	025	055	235
300	120	259	079	180	000	210	030	060	240
305	125	264	084	185	005	215	035	065	245
310	130	269	089	190	010	220	040	070	250
315	135	274	094	195	015	225	045	075	255
320	140	279	099	200	020	230	050	080	260
325	145	284	104	205	025	235	055	085	265
330	150	289	109	210	030	240	060	090	270
335	155	294	114	215	035	245	065	095	275
340	160	299	119	220	040	250	070	100	280
345	165	304	124	225	045	255	075	105	285
350	170	309	129	230	050	260	080	110	290
355	175	314	134	235	055	265	085	115	295

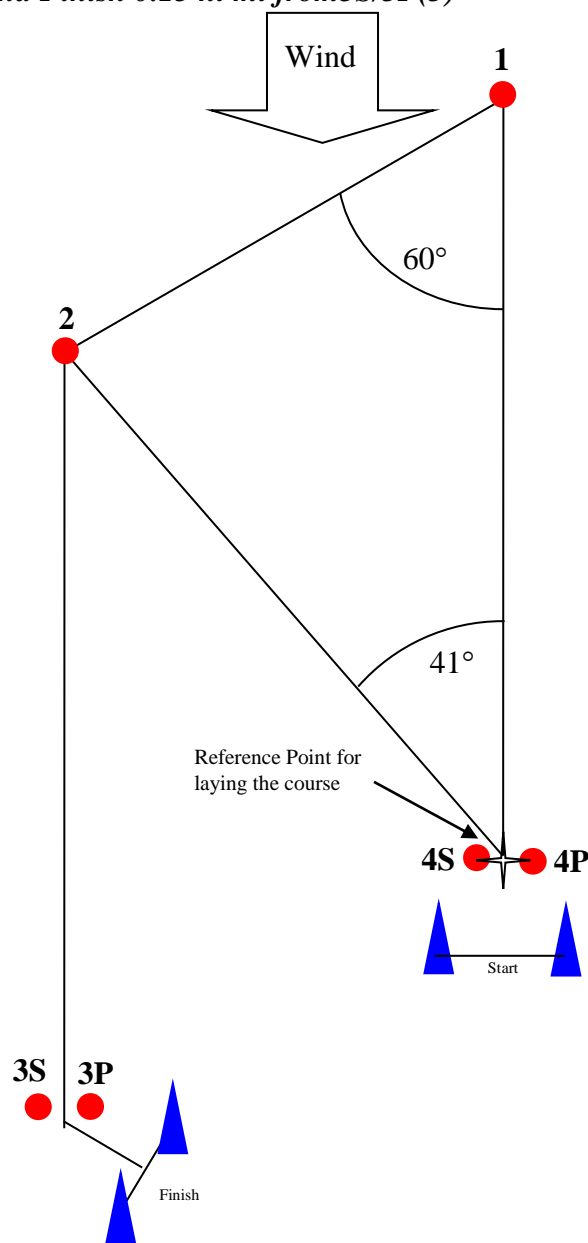
60° Trapezoid Course Lengths to Marks and Course Lengths – Equal beats 1-2 two thirds of beat length

Start 0.05 nt mi downwind of 4S/4P(4) and Finish 0.15 nt mi from 3S/3P(3)

Leg lengths		
4 - 1 & 1 - 4	4 - 2	1 - 2 & 2 - 1
2 - 3 & 3 - 2	& 2 - 4	4 - 3 & 3 - 4
0.20	0.18	0.13
0.25	0.22	0.17
0.30	0.26	0.20
0.35	0.31	0.23
0.40	0.35	0.27
0.45	0.40	0.30
0.50	0.44	0.33
0.55	0.48	0.37
0.60	0.53	0.40
0.65	0.57	0.43
0.70	0.62	0.47
0.75	0.66	0.50
0.80	0.70	0.53
0.85	0.75	0.57
0.90	0.79	0.60
0.95	0.84	0.63
1.00	0.88	0.67
1.10	0.97	0.73
1.20	1.06	0.80
1.30	1.14	0.87
1.40	1.23	0.93
1.50	1.32	1.00
1.60	1.41	1.07
1.70	1.50	1.13
1.80	1.58	1.20
1.90	1.67	1.27
2.00	1.76	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.06	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.2	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53

- I2** Start – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I3** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- I4** Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – 2 – 3P – Finish
- O2** Start – 1 – 2 – 3S/3P – 2 – 3P – Finish
- O3** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish
- O4** Start – 1 – 2 – 3S/3P – 2 – 3S/3P – 2 – 3S/3P – 2 – 3P – Finish



36 Mark Boat Officer Competences

Mark boat officers should be able to consistently demonstrate performance of the following **in rough conditions of open water, winds up to 25 knots with 2 m waves and current up to 2 knots in any direction**

Boat handling - be able to:

- 1 operate a power boat in rough conditions
- 2 standby 5m – 10m from a fixed object (an anchored mark)
- 3 standby 5m – 10m from a drifting object (yacht or person)
- 4 steer to a given compass direction.
- 5 steer to a waypoint given the bearing and distance from a reference position.
- 6 steer to a waypoint given by latitude and longitude.
- 7 come along side an anchored boat in **reasonable** wind and sea conditions to safely transfer objects and people.
- 8 come along side a wharf or jetty.
- 9 anchor in the intended position taking into account current, wind, waves and water depth.
- 10 retrieve the boat's anchor using a retrieval ball within 2 minutes of being given the instruction.

Mark Laying - be able to:

- 11 inflate and deflate marks in no longer time than would be taken on land.
- 12 lay a mark within 20m of a given position consistently, without problems within 2 minutes, with the mark upright and with allowance made for current, waves and wind.
- 13 retrieve a mark (anchored in 30 m of water) when standing nearby within two minutes of being given the instruction.
- 14 retrieve a mark using the retrieval buoy method.
- 15 read the supplied tables to obtain the distance and bearing to the reference point of each mark of the course given the course axis and the distance to mark 1
- 16 stream and tow a mark to facilitate dropping in a desired position. (e.g. for a gate mark, start mark or finish mark)
- 17 be one of two boats to lay a pair of gate marks the correct distance apart and at the correct angle, with allowance made for current, waves and wind.
- 18 correct a gate mark position to achieve the correct orientation and distance.
- 19 replace a mark with a small buoy and vice versa.

GPS Usage – be able to:

- 20 enter a latitude and longitude of a given position.
- 21 enter the boats position into the GPS using the Mark function (“ping” a position)
- 22 rename waypoints
- 23 save a new waypoint given a range and bearing from an existing waypoint
- 24 use the MOB function to identify a reference position
- 25 retrieve from the GPS the latitude and longitude of saved waypoints and present position.

Laser Range Finder Usage – be able to:

- 26 Set a laser range finder to metres and be able to use it to find the distance to an object.

Recording – be able to:

- 27 measure and record wind speed and direction from a drifting boat and graph to obtain trends.
- 28 measure and record current data
 - (i) using a tide stick
 - (ii) using the GPS in strong current.
- 29 record mark roundings with times.

Using a radio – be able to:

- 30 use correct procedures when transmitting and receiving radio communications.

Signal RRS information during a race – be able to:

- 31 anchor in the correct position to signal a course change, or Flag O/R or (shorten course), Flag M
- 32 know the correct flags and signals (visual and sound)
- 33 signal Postponement or abandonment.
- 34 display the correct signal within 30 seconds of the instruction.