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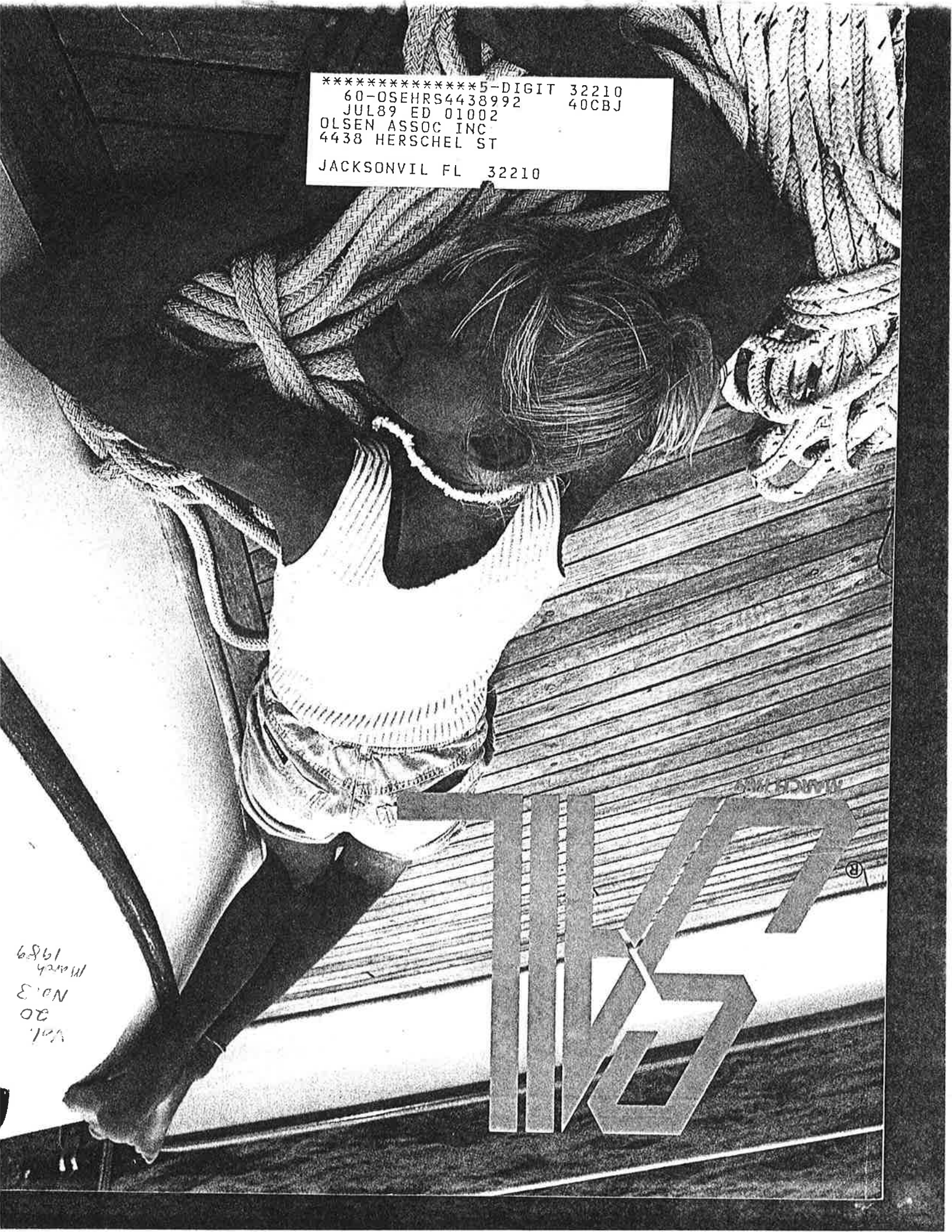


Try a trick to find a reciprocal

Kevin R. Bodge shares a quick and easy way to calculate reciprocal bearings

Suppose you need to come up with a reciprocal bearing for, say, taking measurements along a grid or plotting a course for a race or cruise. The reciprocal, or opposite heading, of a compass bearing is often needed quickly when you're sailing. This means that you need to add or subtract 180 degrees to or from the given bearing.

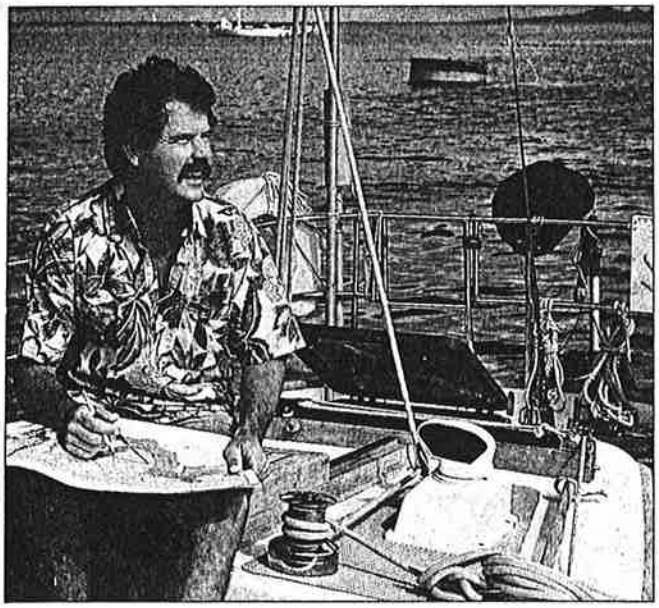
The problem is that for some of us, myself included, adding or subtracting numbers greater than 10 is sometimes elusive. Fortunately, there's a simple rule you can use to invert compass directions *except* those smaller than 10: *Reciprocal bearings have identical units places, and the sum of the tenths and hundredths places of one bearing always equals that of the reciprocal bearing.* The units places are always identical because you are adding a number to 180; the sum of any number and zero is, of course, the number you started with.

Put another way, for any heading except 000°–009° and 180°–189°, the sums of the first two digits of both bearings will be equal. The last digits of the bearings are always identical. For example:

- 074°–254° (0 + 7 = 2 + 5 = 7)
- 344°–164° (3 + 4 = 1 + 6 = 7)
- 196°–016° (1 + 9 = 0 + 1 = 10)
- 115°–295° (11 = 2 + 9 = 11)

Note that you treat a 1 and a 1 in the hundredths and tenths places as the value 11; treat a 1 and a 0 in these

Plotting a reciprocal bearing quickly can be very useful in determining a precise position on a chart



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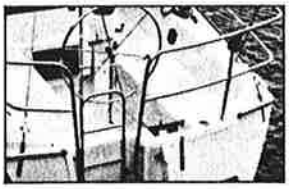

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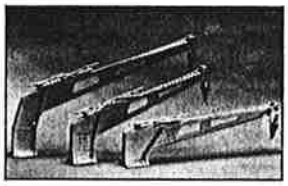

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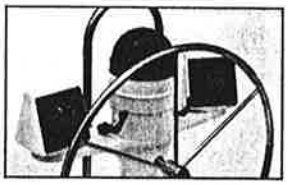

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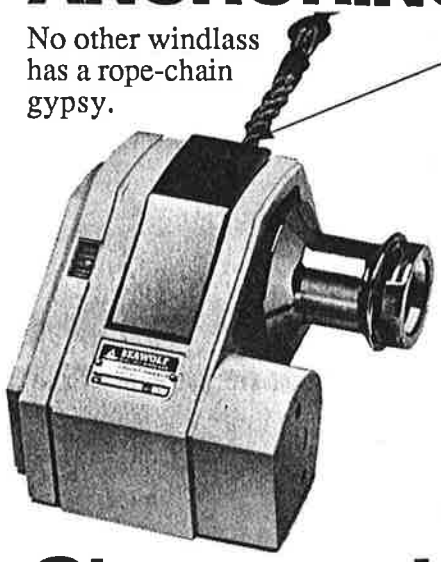

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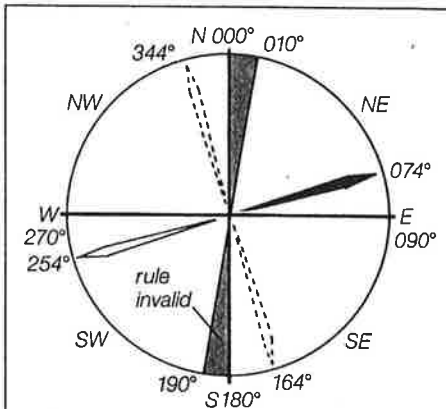

The reciprocal rule says the sums of the first two digits of two opposite headings will equal each other and the last digits will be identical, except in the 10-degree shaded area. If a multiple answer is possible, choose the number that applies to the opposite compass quadrant

places, in either order, as the value 10.

In some cases more than one combination of digits could satisfy the reciprocal rule. In the first example you might conclude that the reciprocal of 074° could be either 164°, 254°, or 344°. However, it's easy to get the correct value by visualizing the quadrant of the compass in which the opposite of the given heading will fall (see figure). In this case, the opposite of 074° in the northeast quadrant is 254° in the southwest quadrant.

This reciprocal rule is not new; some sailors and pilots have used it for years. With a little practice, you'll find computing or verifying a reciprocal bearing with this system very easy and quick to do.

I might also mention that inverting headings is simpler in higher-base mathematics. It is the carryover in the tenths place imposed by base-10 math that creates the difficulty for us when we mentally invert a heading. Using a base higher than 10 avoids this carryover. In fact, base-20 happens to be the lowest convenient choice.

To invert a heading in base-20, simply add 9 to, or subtract it from, the first digit of the heading. However, since it's difficult to convert between base-10 and base-20 while you're sailing, and it's even more difficult to find a compass graduated in base-20, you're better off sticking to the reciprocal rule I've described here.

Kevin Bodge is a coastal engineer who spends much of his time on boats and around compasses. He also enjoys racing in the Jacksonville, Florida, PHRF fleet.