

Double Bends

1. OVERVIEW

Airplane customers sometimes need to mount our sender in the side of a wing tank, then bend it to the top of the tank and bend it again back to the bottom of the tank. It's not our favorite configuration because it often leads to tech support. Also, it's not ideal for linearity because half the tank has two sections of tubing and half the tank has one section.

2. MUST BE BENDABLE

To allow our senders with 1/4" tubing to be bent without cracking, they must be ordered with a **bendable section**. The top of the bendable section is the head. The bottom of the bendable section will be indicated by a **black magic marker circle** drawn on the tubing.

About half the tank height plus 3 inches is a good length for the bendable section. So for example CGFP-24A/7"BNDBL for an 8 inch tall tank.

3. IMPORTANT: MOUNTING HOLES AND MARKING THE BEND DIRECTION

The 5 mounting holes in an SAE bolt pattern are not equally spaced. You need to rotate the sender to find which of the 5 rotations matches the holes perfectly. Some rotations will be close for 4 of 5 holes!! but only one will be perfect. When you find the perfect one, make a mark on the head to show the bend direction to the top of the tank.

4. MAKING A JIG (not required, but helps to do accurate work)

1/2" PVC end caps (which measure 1.06 diameter) are good to use as bending axles for the tubing. Get piece of wood to use as your bending jig. Cut a notch for the neck of the sender and put the head against the side of the board with the neck in the notch such that the tube is sitting on the surface of the board. Your tick for bend direction should be at the edge of the board. It's best if you can screw one of the mounting holes into the edge of the board to lock the sender in place.

Mark the board with lines for the top and bottom of the tank.

Drill a hole in each of the pvc end caps so you can screw them to the board to act as a bending axles. Only install the one closest to the head first.

Bend around that first cap until you've reached the angle where you can install the second cap to bend around. The top of that cap should be at least 1/2 inch below the top of the tank.

Bend around the second cap to whatever angle leaves you about 1/2 inch above the bottom of the tank. **IMPORTANT:** your tubing must be straight again by the time it reaches the black circle which

indicates the end of the bendable (insulated) section. If it's still curving, the inner tube may short to the outer and you'll get a constant Empty reading.

The longer you can keep that second section compared to the section near the head, the better. This is because the section above the head has more tubing per vertical inch than the section below the head, so the upper section will respond too strongly.

If you have to shorten the tube, use tubing cutter for the outer tube and then carefully (to protect your fingers, not the sender) ream the inside bottom of the outer tube with an Xacto knife. Then use small side cutters to nip off the inner tube. It doesn't matter if you pinch it closed.

5. 1/16" BREATHER HOLE

You must add a 1/16 inch breather hole in the tubing at the highest point in the second bend. That's so air can go in and out the top as the fuel level in the tubing changes. Otherwise you will have an air pocket in the upper section that won't fill with fuel and you might just as well have done a single bend.

Bending is a delicate operation to drill that hole. Some problems you may cause:

--if you 'punch' through the outer tube, you can damage the inner tube

--if you get metal shavings in the tubing, it can short out your reading.

So I suggest a fresh drill bit, drilling weakly, and blowing out the shavings as you go along.

6. RECALIBRATE

Because bending the tubing changes the capacitance a bit, you'll want to recalibrate the sender's Empty and Full per the instructions.

7. PROBLEMS?

There's a general troubleshooting form at www.centroidproducts.com that will point us in the right direction.



INSTRUCTIONS

1. SENDER DIMENSIONS

Page 2 of this form will tell you how to calculate the dimensions of a sender with a bend.

2. WIDE @ ?? O'CLOCK

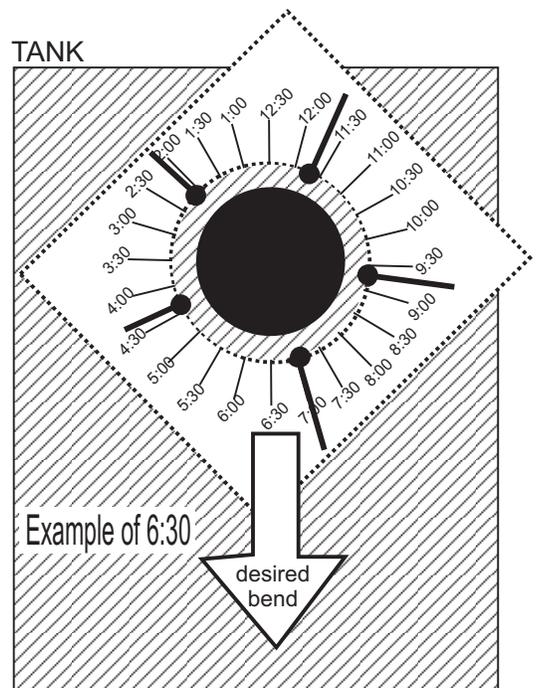
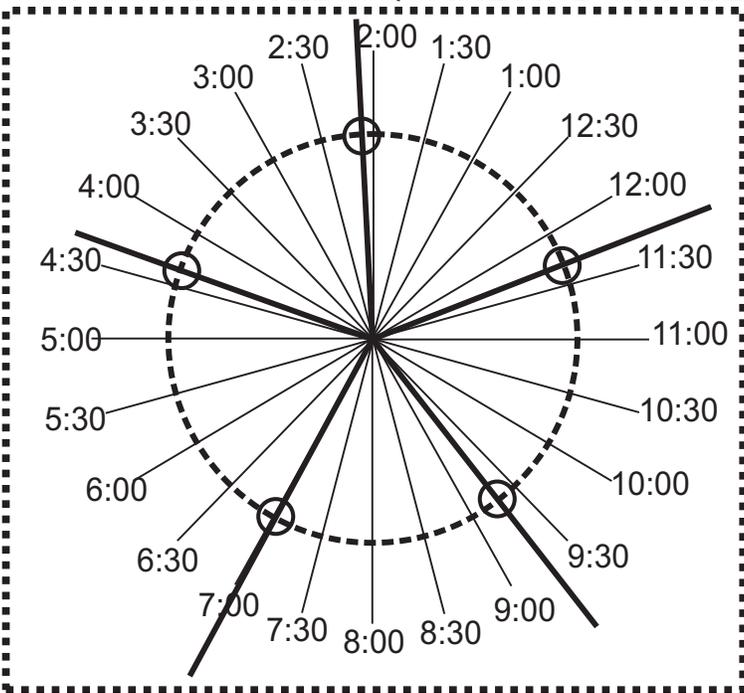
For a bent sender to point the correct direction in the tank when installed, the bend must be at the correct orientation with respect to the five mounting screws. The template on this page will provide a "wide @ ?? o'clock" number for Centroid to use. NOTE: if you will drill the five mounting screw holes to match the sender, we will use our default orientation of "wide @ 8:00".

A. Cut out the dotted square and circle below. YOU MUST DO THIS. Please dont just eyeball it.

B. Rotate the cutout on the tank opening or face of the original sender (not the back) through all 5 rotations of the tick marks.

C. Once you've found the best of the 5 rotations, which o'clock number is pointing the direction you want the bend to point? _____

CUT OUT DOTTED SQUARE AND CIRCLE



2. DIMENSIONS OF A SENDER WITH A BEND

A. OVERVIEW

When a bent sender is needed, it is typically at 90 degrees for a side-mount, usually when the top of the tank is not accessible or has insufficient clearance to insert the sender. Occasionally a top-mounted sender has a bend too, when the tank opening is not above the deepest part of the tank. However, often the fuel being missed in this situation is a small percentage of the total gallons, even if it is a bigger percentage of the inches. In that case, it's generally better just to leave that small percent of gallons as a reserve than to have the sender bend toward it. Otherwise the reading will drop surprisingly quickly in this section due to small gallons in bigger inches.

B. CENTROID'S TUBING BENDER

Our bend jig makes bends approximately 3 inches from the head. Rather than have customers make trigonometric calculations, the form below has you specify the desired vertical and horizontal offsets from the center of the mounting hole to the tip of the sender. (In the case of a 90 degree bend, the horizontal offset is 3 inches).

C. EXISTING SENDERS WITH BEND

A modern bent sender (ie with a white label) will show a part number of the form CGFP-12.5+2.5@90-...-w@8:00 This gives sufficient information for us to duplicate the bend.

And old sender (ie with silver labels) will not show this information. Often Mary will be able to find your original order (we have order information back to 1990 or so) and get the information that way. Or if you put the sender head against the edge of a table, you'll be able to measure the vertical and horizontal offsets from the center-bottom of the sender's head to the tip of the sender. (You'll also need the 'wide @ ?? o'clock' from the first page of this form).

