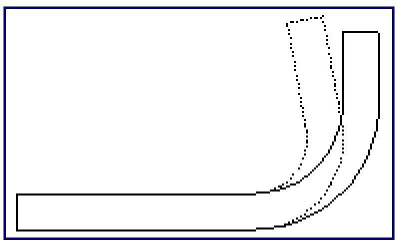
What is CLR?

CLR is the "Center Line Radius". This is a common term in the tubing industry and it is used to describe the radius of a bend.

The CLR is the radius down the center of the tube. Other fabrication processes use Outside or Inside Radius like Sheet Metal Fabrication. Again, tubing uses the center of the material.

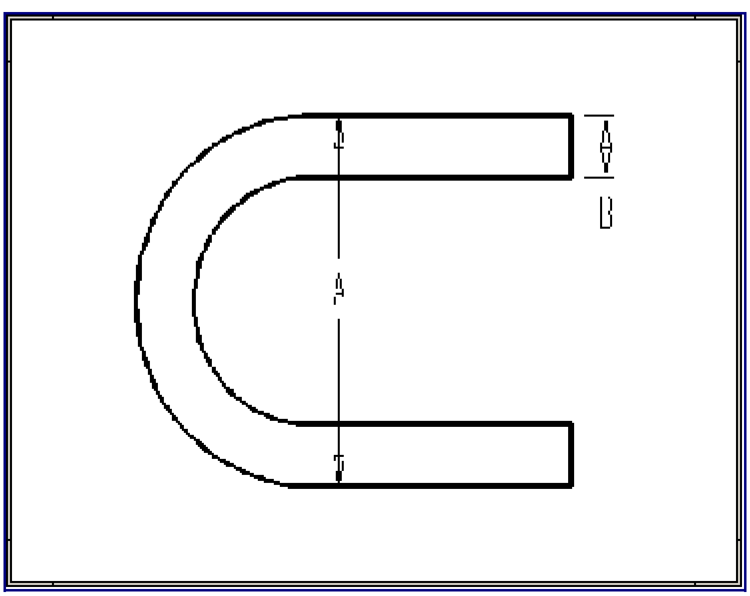
The CLR on many dies will be larger than what is labeled on the die!!! This is especially the case when you are not using a mandrel (most of you are not) and you are not using push assist. This increase in the CLR is caused by "Spring Back". As the material is spinging back the radius is spinging open. Compare this to a copper wire you wrap around a pencil a couple of times. When you release the wire the radius will open up and make the wire fall down the pencil. Same thing is happening with most dies and the tubing.



How do I find the true CLR?

If your die allows you to bend 180 degrees then: Bend a tube to 180 degrees after spring back. Measure the outside of the legs near the start and end of the bend “A”. Measure the tube outside diameter “B”.

Formula: CLR = (A-B) / 2



If you die does not allow for 180 degree bends then:

For most benders use this formula: Formula: CLR = die size * 1.042

On benders using mandrel or push assist use the CLR labeled (or die size) on the die. NOTE: A mandrel bender is the environment where you have a rod inside the tube to hold the wall while bending.

When the value for the CLR is found you need to update the tool in the tooling library.

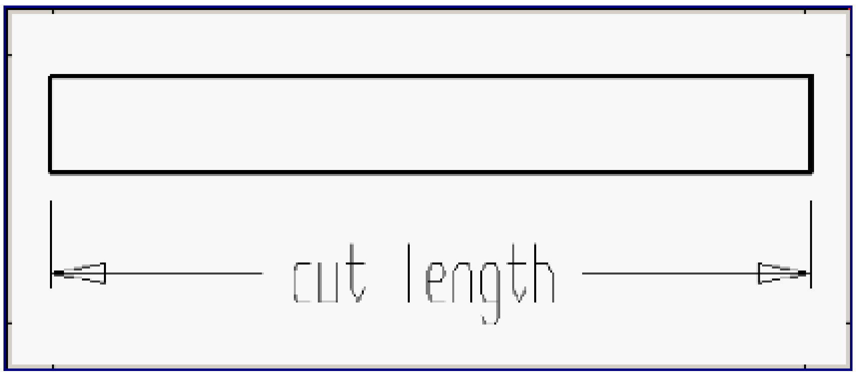
What is Calibrated CLR?

This is the center line radius that is the mathematical radius for determining material growth through the bend

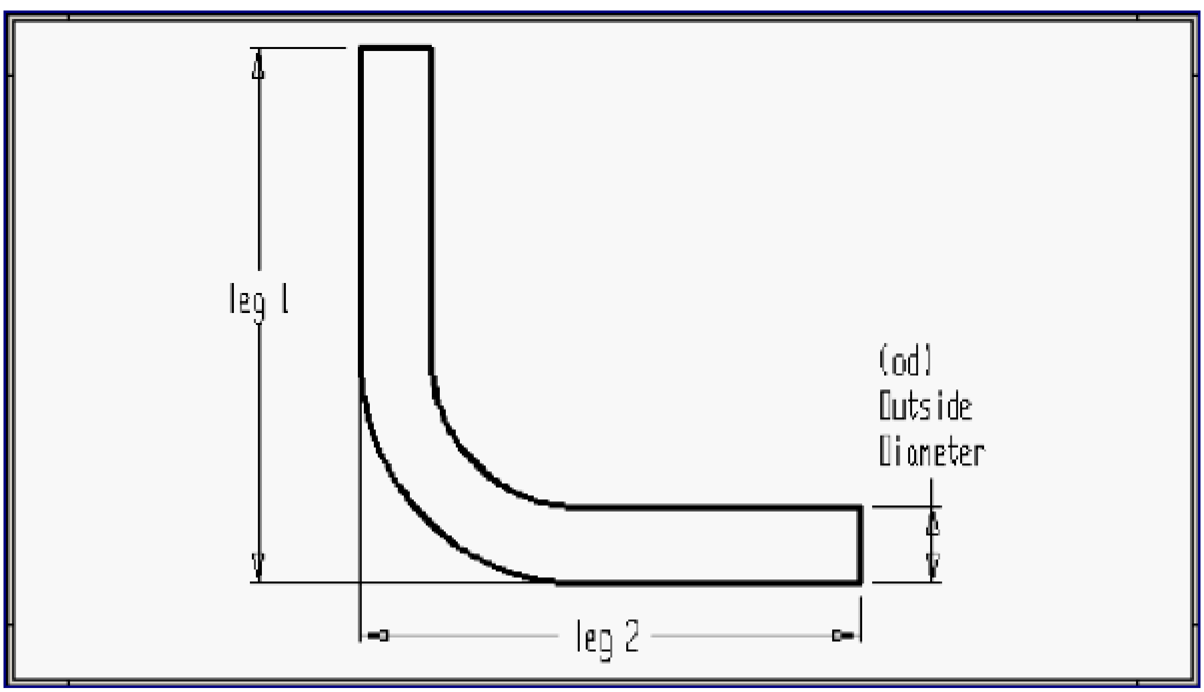
Finding your Calibrated Centerline Radius

To find the Calibrated CLR use the following procedure:

Cut a piece of tube and measure it after the cut (cut length).



Bend it to 90 degrees such that the bend is 90 degrees after bending. The location of the bend is not needed for this formula, so you may bend it anywhere as long as there is enough material to properly go through your bender.



The OD is the outside tube diameter.

Formula: Calibrated CLR = (leg1 + leg2 - cut length - OD) * 2.33

Note: You should find the Calibrated CLR to be 5 to 20% larger than the labeled CLR on your die.

What is Bend Location Offset?

Bend Location Offset is the distance between where the bend truly starts in the die and the position on the die or bender where you desire to line up the bend mark locations on the material. As an example, many users will use the end of the die to line up the bend mark location. In this case the bend does not start at the end of the die, but maybe .750 of inch into it.

The Bend Location Offset moves the bend line marks up or down the tube. The direction is determined by the value. If the first leg of tube is too long than the value needs to be a negative number by the amount off and if it is too short the value is a positive number by the amount off.

If you know where your bend starts and are using a mark on the die or using a CNC machine, determining Bend Location Offset will be unnecessary.

Use the following procedure to determine the Bend Location Offset:

Select or cut a piece of material that will allow you to make a 90 degree bend. Place a mark a couple of inches down the tube (we are going to use 4 in our example). Line this mark on the tube to the position on the die or bender you would like to use as your position indicator (examples: end of the die, strap, screw, etc…). Bend the part creating a 90 degree bend when completed Measure the outside length of the leg (this is the one with the mark on it).

Formula: Bend Location Offset = CLR + Mark Location + (1/2 of the OD) - leg length

Example: Bend Location Offset = 6.25 + 4.0 + .875 - 1.875 = -.75

Notes:

- OD is the Outside Material Diameter
- The CLR is the value determined earlier in the manual in Step 1.
- The Mark Location is the distance from the end of the tube to the mark
- The leg length is measured similar to either legs in Step 2 earlier in this manual

Important: If your bender is a ROTARY COMPRESSION such as the JD2 Model 4, the Hossfeld bender or as described in Step 3 earlier in the manual then the sign needs to be reversed. So this means in our example of –.75 the correct value will be .75

How to Mark and Run the Material through the Die

If you have an environment where the tubing is held into place with a chuck, most likely you will need the **"LRA extension module"** and this post won't do anything for you. Please find some definitions in the LRA section of this forum.

For EVERYONE else:

Die: 2.00 Cut Length: 63
Material: 2.0 Part Weight: 0

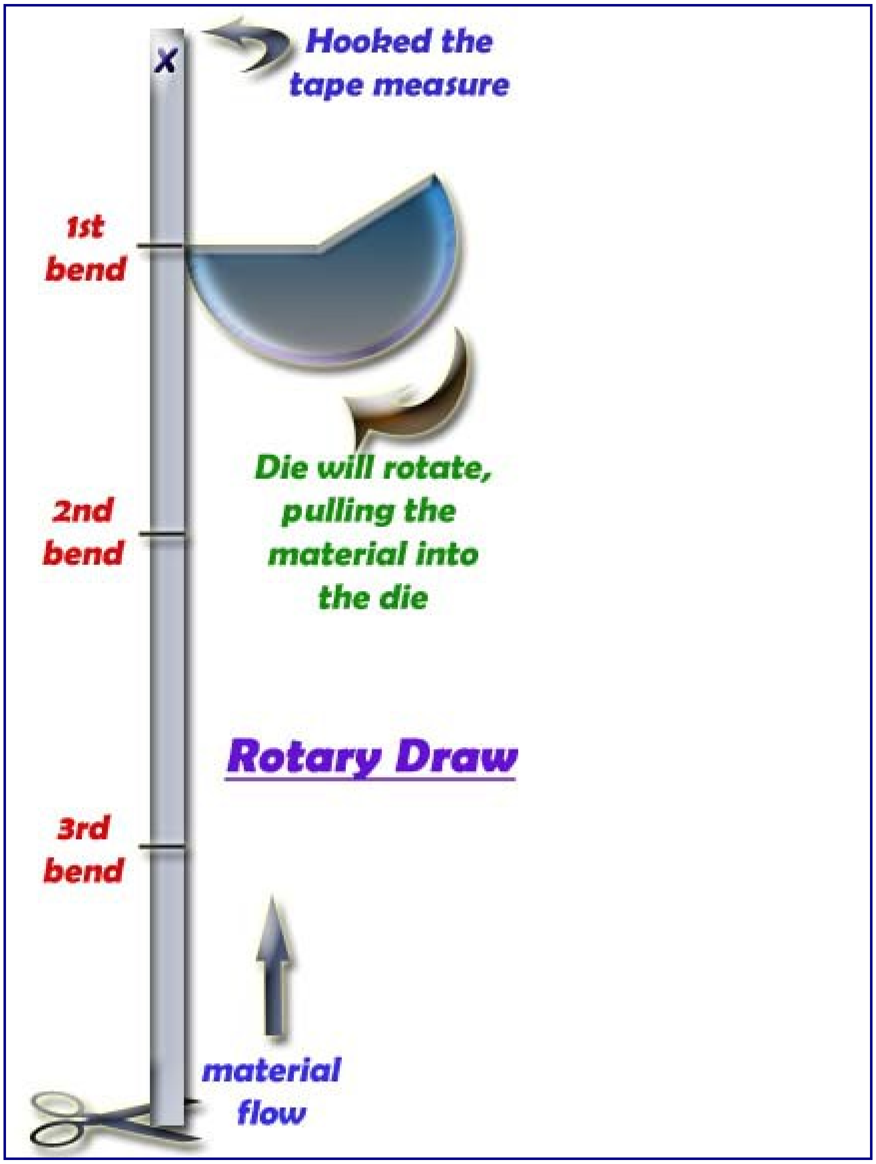
A	B	Location	Rotation	Angle	CLR	Bend Length	Orientation
1	1	5	0	45	2	2	From Start
2	2	21	238	62	2	2	From Start
3	3	47	201	90	2	3	From Start

The above results show a "cut length" and the "Location"s where to place the bend lines. Hook your tape measure on one end (**Place an "X" on the end you hook**) and mark off the bend locations and the cut length.

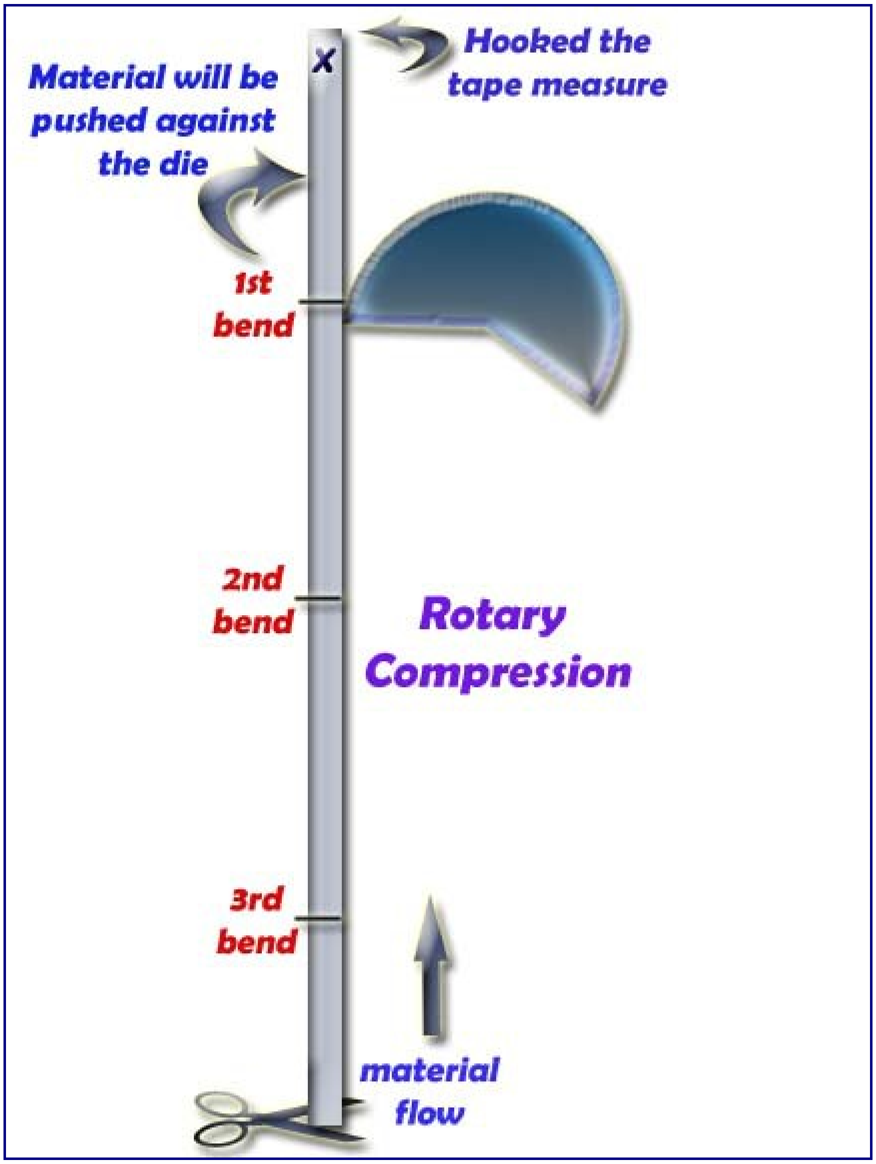
The "X" goes into the die first (see diagrams below). Start at bend 1, complete the bend, and push the material into the bender to bend 2 and so on. Please note you are able to flip the tubing with the "flip" command (EZ-3D, PRO and SE).

Placing the material into the die from the correct end is very important. Determain if you have a **"rotary draw"** or **"rotary compression"** bender and follow the diagrams below:

Rotary Draw


X
Hooked the tape measure
1st bend
2nd bend
3rd bend
Die will rotate, pulling the material into the die
Rotary Draw
material flow

Rotary Compression



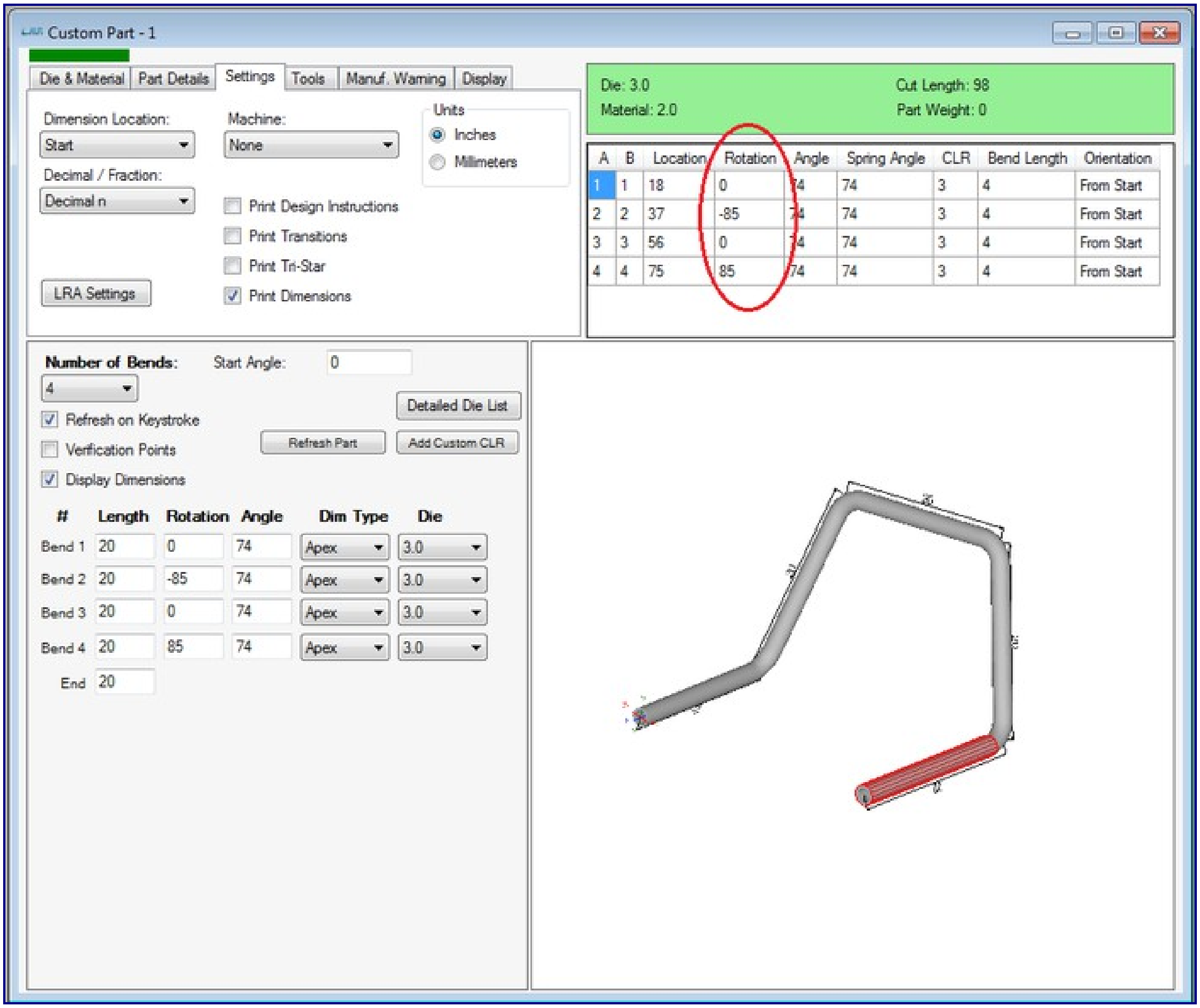
Using an Angle Level

For guys who have NOT purchased the LRA Extension Module and want to use a dial level, please follow this thread carefully.

Bend-Tech as a default (without the LRA module) uses incremental rotations between bends. In other words, after each bend is performed that current rotation angle becomes 0 degrees.

After the 2nd bend you will need to calculate the absolute (rotations from 1st bend position) rotations.

Here is an example:



There are several types of angle levels available and many of them use different angle call outs. We are going to cover the 2 most common:

1) Your angle level is numbered from 0 to 360

Here are your results from our example

bend 1) 0 = 0 (the first one is always 0 degrees)

bend 2) -85 = 275 (360 + -85 = 275)

bend 3) 0 = 275 (275+0 = 275)

bend 4) 85 = 0 (275+85 = 360 = 0)

2) Your angle level is numbered from 0 to 180 and 0 to -180

bend 1) 0 = 0 (the first one is always 0 degrees)

bend 2) -85 = -85 (0 + -85 = -85)

bend 3) 0 = -85 (-85 + 0 = -85)

bend 4) 85 = 0 (-85 + 85 = 0)