

# K-Factor in Autodesk Inventor Sheet Metal Parts

The 'K' Factor in sheet metal is the ratio of thickness to the location of the neutral line in the metal cross section. In Inventor this ratio determines the final size of the unfolded sheet metal part.

Intermediate Inventor Users

The definition below is taken from wikipedia [http://en.wikipedia.org/wiki/K-factor\\_\(sheet\\_metal\)#K-factor](http://en.wikipedia.org/wiki/K-factor_(sheet_metal)#K-factor)

## ***K-factor***

*K-factor is a ratio of material thickness to the location of the neutral line as defined by  $t/T$  where  $t$  = location of the neutral line and  $T$  = material thickness. The K-Factor formulation does not take the forming stresses into account but is simply a geometric calculation of the location of the neutral line after the forces are applied and is thus the roll-up of all the unknown (error) factors for a given setup. The K-factor depends on many factors including the material, the type of bending operation (coining, bottoming, air-bending, etc.) the tools, etc. and is typically between 0.25 to 0.5.*

*The following equation relates the K-factor to the bend allowance.*

$$K = \frac{-R + \frac{EA}{\pi A / 180}}{T}$$

In order to get your Inventor models to match your production environment, you are going to need to determine what your K-Factor is for your specific manufacturing process and material. There are generic tables available for estimating the K-factor, but probably the best method, is to reverse engineer the K-Factor that your process is producing.

The information on page 2 about reverse engineering your K-Factor is taken from the following document <http://www.ciri.org.nz/bendworks/bending.pdf>



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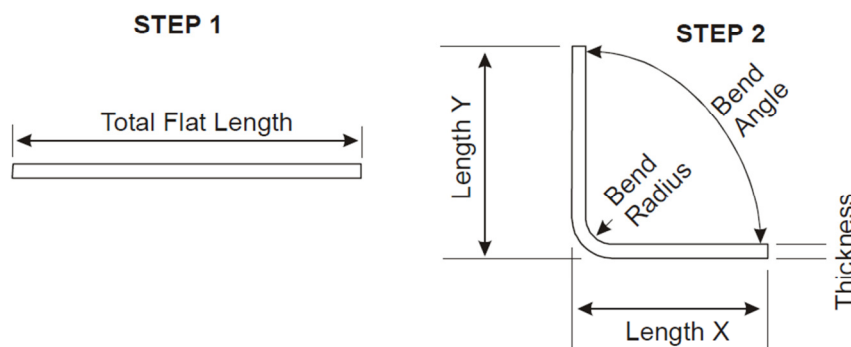
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## REVERSE ENGINEERING THE K-FACTOR

First, cut a strip of material and measure its length and thickness as accurately as possible. The width of the strip is not that critical but generally somewhere around 100mm (4 inches) or so usually does the trick.

Then, bend the strip to 90 degrees, and measure its Length X and Length Y as shown in the diagram below.

**Note that it is very important to bend the sample piece in exactly the same manner as you plan to bend your real pieces, so that whatever you measure now becomes reproducible later.**



The bend radius can be extremely difficult to measure accurately but, in this case, is not critical (within reasonable limits, of course!). The reason it is not critical is that what we are interested in is a number to use in our CAD program that, with the bend radius used in our CAD program, will produce the results you are measuring in real life.

In other words the K-factor you calculate now will take into account any small inaccuracies in the bend radius measurement and compensate for it. If, for example, we are using a Bend radius of 0.5 in our CAD program, it does not matter if our real tooling radius is actually 0.4, as the K-factor, which was worked out from our real tooling, corrects for this. The only implication of this is that we may occasionally get a K-factor that seems odd (higher than 0.5, for example) if our real radius is very different from our CAD program radius. Remember though that most CAD programs such as Solidworks only accept K-factor values from 0 to 1, so if the calculated K-factor is outside these limits, then you may need to double-check your numbers.

The correct K-factor to use in your CAD program can now be calculated as follows:

$$\text{BendDeduction} = \text{Length X} + \text{Length Y} - \text{Total Flat Length}$$

$$\text{OutSideSetBback} = (\tan(\text{BendAngle} / 2)) * (\text{thickness} + \text{BendRadius})$$

$$\text{BendAllowance} = (2 * \text{OutSideSetBback}) - \text{BendDeduction}$$

$$\text{K-Factor} = (-\text{BendRadius} + (\text{BendAllowance} / (\pi * \text{BendAngle} / 180))) / \text{thickness}$$

Using this method will produce the most acceptable results other than by using a bend table.