

# VR3 Engineering Tube Bending: Guidelines

## Guidelines for Bending and Forming Tubes

March 2013 

VR3 has developed expertise in bending and rolling tubes to suit a variety of applications. This knowledge combined with the pre-profiling of the tubes produces accurate formed tube components ready to weld.

VR3 has developed a process to extract bend data from a 3D solid model to produce tube components with multiple bends in 3D space while maintaining the end profile orientations.

Tube bending for most structural tube applications use a 'rotary draw' process. Mandrel bending is not practical or economical for these lengths, quantities and tube sizes.

The following are constraints and preferences of our tube bending process when combined with end profiles:

tubes are formed using bending dies specific to the tube outside diameter and centerline radius.

1. The centerline bend radius is generally in the range of 3 to 4 times the tube od.
2. Thicker wall tubes can be bent to tighter radii.
3. Thinner wall tubes have minimum bend radii and limited bend angles.
4. Bend angles greater than 90 degrees require thicker wall thicknesses.
5. Shallow bend angles less than 20 degrees can sometimes be achieved with thinner wall tubes.
6. Minimum distances between bends are required for multiple bends, typically about 4.00" inches.
7. Minimum straight tube lengths of aprox 4.00" are also required from the end of a tube to the start of a bend. This is required to properly support the tube during bending.
8. Minimum bend radii are also subject to the material properties.
9. Refer to the chart for bending dies currently available.
10. If possible by design, consider using the larger bend radius.

***See sheet 2 for current List of Bend Dies.***

# VR3 Engineering Tube Bending: Bending Die Chart

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Tube OD (in.)	Centerline Bend Radii (mm/in)	Minimum wall thickness (inches)
		(in.) (mm/in.) Based on 90 degree bends. Thinner walls are not recommended but may be achievable on bends < 20 deg.
0.375"	36mm / 1.417"	>or = .035"
0.500"	36mm / 1.417"	>or = .049"
0.625"	46mm / 1.811"	>or = .049"
0.750"	46mm / 1.811"	>or = .058"
	67mm / 2.638"	>or = .049"
	98.4mm / 3.875"	>or = .049"
	6.000"	>or = .035"
0.875"	46mm / 1.811"	>or = .083"
	67mm / 2.638"	>or = .049"
1.000"	56mm / 2.205"	>or = .120"
	67mm / 2.638"	>or = .095"
	82mm / 3.228"	>or = .058"
	149.2mm / 5.875"	>or = .035"
1.125"	67mm / 2.638"	>or = .083"
	82mm / 3.228"	>or = .058"
1.250"	82mm / 3.228"	>or = .120"
	112mm / 4.409"	>or = .065"
1.375"	82mm / 3.228"	>or = .083"
	112mm / 4.409"	>or = .049"
1.500"	100mm / 3.937"	>or = .083"
	150mm / 5.906"	>or = .065"
1.625"	130mm / 5.118"	>or = .083"
1.750"	150mm / 5.906"	>or = .083"
	170mm / 6.693"	>or = .083"
2.000"	150mm / 5.906"	>or = .120"
	190mm / 7.480"	>or = .083"
½" pipe (.840" od)	R56mm (2.205")	
¾" pipe (1.050" od)	R67mm (2.638")	
1" pipe (1.315" od)	R67mm (2.638")	
	R112mm (4.409")	
1 ¼" pipe (1.660" od)	use 1.625" OD tube die (R130mm / 5.118")	