

Guidelines for Bending and Forming Tubes

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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

Applications include roll cages, longerons, tail feathers, railings, spiral handrails.

There are preferences and constraints to tube bending:

1. tubes are formed using bending dies specific to the tube outside diameter and centerline radius.
2. the centerline bend radius is generally in the range of 3 to 4 times the tube od.
3. thicker wall tubes can be bent to tighter radii
4. thinner wall tubes have minimum bend radii and smaller bend angles
5. bend angles greater than 90 degrees require thicker wall thicknesses
6. shallow bend angles of 10 to 30 degrees can be achieved with thinner wall tubes.
7. minimum distances between bends are required for multiple bends, typically about 5 inches
8. minimum straight tube lengths of 4" to 5" 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
9. minimum bends are also subject to the material properties.
10. refer to the chart for bending dies currently available.

Tubes can also be rolled to larger radii using a 3 roll process:

1. the centerline bend radius is generally greater than 10 times the tube od
2. the bend radius is subject to the tube od and wall thicknesses
3. A set of 3 rolls for any given tube od is required. An infinite range of radii beyond the minimum can be produced with one set of rolls
4. tube rolling is typically done in one plane with the exception of spiral handrails and other architectural applications
5. xxx

Both of the above processes can often be combined to produce complex tubes eliminating mitre joints, splices and weld seams.

Bending Die Chart: Guidelines

Tube OD (in.)	Centerline Bend Radii (mm/in.)	Allowable minimum wall thickness (inches) based on 90 degree bends Thinner walls may be acceptable on shallower bends
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" 67mm / 2.638"	>or = .058" >or = .049"
0.875"	46mm / 1.811" 67mm / 2.638"	>or = .083" >or = .049"
1.000"	56mm / 2.205" 67mm / 2.638" 82mm / 3.228" 4.500"	>or = .095" >or = .083" >or = .058" >or = .095" ** special
1.125"	67mm / 2.638" 82mm / 3.228" 112mm / 4.409"	>or = .083" >or = .058" >or = .058"
1.250"	82mm / 3.228" 112mm / 4.409"	>or = .083" >or = .049"
1.375"	82mm / 3.228" 112mm / 4.409"	>or = .083" >or = .049"
1.500"	100mm / 3.937" 150mm / 5.906"	>or = .083" >or = .065"
1.625"	130mm / 5.118"	>or = .083"
1.750"	150mm / 5.906" 170mm / 6.693"	>or = .083" >or = .083"
2.000"	190mm / 7.480"	>or = .083"