



Commercial Pipe and Wall Thickness

Nominal Pipe Size	Outside Diameter	Schedule 5	Schedule 10	Schedule 40	Schedule 80	Schedule 160	Schedule XXS
6.35mm 1/4"	13.7mm 0.540"	1.20 0.049	1.72 0.065	2.24 0.088	3.02 0.119		
9.52mm 3/8"	17.1mm 0.675"	1.20 0.049	1.72 0.065	2.31 0.091	3.20 0.126		
12.7mm 1/2"	21.3mm 0.840"	1.72 0.065	2.11 0.083	2.77 0.109	3.73 0.147	4.78 0.187	7.47 0.294
19.1mm 3/4"	26.7mm 1.050"	1.72 0.065	2.11 0.083	2.87 0.113	3.91 0.154	5.54 0.218	7.82 0.308
25.4mm 1"	33.4mm 1.315"	1.72 0.065	2.77 0.109	3.38 0.133	4.55 0.179	6.35 0.250	9.09 0.358
31.8mm 1-1/4"	42.2mm 1.660"	1.72 0.065	2.77 0.109	3.56 0.140	4.85 0.191	6.35 0.250	9.70 0.382
38.1mm 1-1/2"	48.3mm 1.900"	1.72 0.065	2.77 1.109	3.68 0.145	5.08 0.200	7.10 0.281	10.16 0.400
50.8mm 2"	60.3mm 2.375"	1.72 0.065	2.77 0.109	3.91 0.154	5.54 0.218	8.74 0.343	11.07 0.436
63.5mm 2-1/2"	73.0mm 2.875"	2.11 0.083	3.04 0.120	5.16 0.203	7.01 0.276	9.52 0.375	14.02 0.552
76.1mm 3"	88.9mm 3.500"	2.11 0.083	3.04 0.120	5.49 0.216	7.62 0.300	11.13 0.438	15.24 0.600
88.9mm 3-1/2"	101.6mm 4.000"	2.11 0.083	3.04 0.120	5.70 0.226	8.10 0.318		15.91 0.636
101.6mm 4"	114.3mm 4.500"	2.11 0.083	3.04 0.120	6.02 0.237	8.56 0.337	13.49 0.531	17.12 0.674
127.0mm 5"	141.3mm 5.563"	2.77 0.109	3.38 0.134	6.55 0.258	9.52 0.375	15.88 0.625	19.1 0.750
152.4mm 6"	168.3mm 6.625"	2.77 0.109	3.38 0.134	7.11 0.280	10.97 0.432	18.26 0.718	21.95 0.864

Information required for rotary draw tooling applications

- Size and wall thickness of material
- Material type and grade
- Number of bends on part
- Distance between bends
- Plane of bend relationship to one another
- Production rates
- Part tolerances
- Centerline radius of the bends. **Note:** bends with radius less than 2 times OD require greater attention, high grade bendable materials and heavier machine design.

Understanding material to be bent

Bending application success is dependent on several factors including and most importantly the proper material. Obtain a print of work to be done, review dimensions and tolerances. Review the mill certification for material from the mill and confirm the material is appropriate for bending. Use caliper to measure material and confirm dimensions are correct for tooling. Tube OD and wall thickness variations are far more common than you may realize. For some tube fabricating applications, this variation is of little concern, but in rotary draw bending, ID dimension variation is a big issue. The tubing must fit the tooling correctly and have the appropriate clearances.

Note: different types of material can be bent i.e., steel, aluminum, and stainless however the tooling composition and CLR may change to ensure material compatibility. Pay attention to material ordered and confirm it's received as ordered.

Terminology

Bend Specifications

OD is tube outside diameter, usually measured in inches or millimeters. Sometimes the tube outside diameter is expressed in nominal, such as IPS for pipe. Only rarely is a tube diameter specified as an inside diameter. This is non-standard, leads to confusion, and should be avoided. Whatever units are used, OD should be expressed in decimal, to three places in the case of inches.

WT is wall thickness. Inches and millimeters are common units, and again the precision of a decimal number to three places is warranted if inches are used; at least one place for millimeters. Frequently, the old Birmingham Wire Gage Standard is used to express WT; be sure to use the correct gage (there are several standards) when translating to decimal inches. When the Tube OD is expressed as an IPS nominal size, then the WT is expressed as a schedule number, which corresponds to a precise value in inches.

CLR is centerline radius and is the most common reference for bend radius. Again, inches and millimeters are the common units of measurement. Typically, fractional or two-place decimal inches are sufficiently precise. Sometimes the CLR is expressed as a multiple of the Tube OD, such as "1-D", "2-D", and so on. Note that if the Tube OD is expressed as an IPS nominal size and the CLR is expressed as a "D", it is a multiple of the nominal, not the actual tube diameter. Inside radius, abbreviated "ISR", is a common reference for specifying bend radius if the tubing is non-round. Outside radius is seldom used to define the bend radius.

DOB is degree of bend, often loosely referred to as the sweep of bend or depth of bend. This defines in decimal degrees (occasionally degrees and minutes) the arc of the bend. This is, of course, different from "plane of bend" or "orientation", a specification for multi-bend parts which defines in degrees where the plane of the current bend is located relative to the plane of the first bend.

In defining multi-bend parts, XYZ rectangular coordinates are used, from which bend data are developed. Bend data consist of tangent length, plane of bend, and degree of bend and defines the motion of the tube during the bending process.