

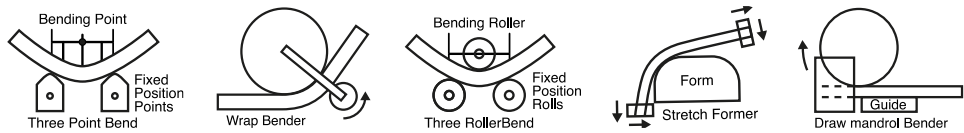
Bending

There are several types of forming machines suitable for bending aluminium sections. The choice depends upon the class of section, whether solid, open or hollow; the range of support tooling available; the alloy and temper. Tubing is by far the most commonly bent form of aluminium. Bending may be carried out by four main methods:

- The three-roll bender has a central moveable roller, which is gradually depressed until the desired radius is obtained.
- The three-point bender has a similar method of operation, the load being either applied gradually or impacted.
- The roll and point methods of bending are usually applied to robust sections. In both wrap and mandrel benders, it is possible to provide formers and other support tools which minimise the amount of buckling and enable tighter radii to be obtained.
- The stretch former puts the section into tension and then, moving laterally, wraps it around a former. This method reduces the likelihood of compression failure.

Drawn tube should be specified where tight tolerances are required and where a higher level of mechanical property is necessary than is available in an extruded product. Drawn tube bends more consistently than extruded tube, again, due to the range in the mechanical properties.

Section bending is a specialist procedure and generally, the soft tempers should be used, particularly for complex shapes.



Bending characteristics

The main criteria governing the bending of aluminium are:

Alloy, temper, metal thickness and/or configuration, bend radius, and equipment available. The most common problem is the determination of a minimum radius at which a bend can be formed without developing cracks or excessive "orange peel" along the external bend radius. A closely related problem is the amount of overbending necessary to compensate for elastic recovery (springback), both of these conditions vary with alloy, temper and thickness.

Severe bending may require annealed material, whereas moderate bending with generous radii allows for the use of harder tempers.

The radius of bend for extruded profiles is governed to a large extent by the amount of distortion which can be tolerated from an aesthetic point of view. Angles, channels, Z-sections, top hat sections and I-sections all require closely fitting tools and formers to hold distortion to a minimum. Extruded sections can be bent more easily over small radii in the T4 temper. If required, the properties can be subsequently increased to T5 or T6 temper by artificially ageing. Additional recommendations are given in the AAC publication, "Aluminium Standards Data and Design Wrought Products".

TUBE SIZE		RADII FOR VARIOUS ALLOYS AND TEMPER (mm)											
OUTSIDE DIAMETER (MM)	WALL THICKNESS (mm)	1200-0 1350-0		6106-0 6060-0 6063-0 6061-0		6106-T4 6061-T4 6063-T4 6082-T4		6060-T5 6063-T5&T6 6101-T5&T6 6106-T6		6005A-T6 6061-T6 6082-T6		6060-T81 6063-T81	
		10	1 1.6	12 10	15 13	16 14	18 13	20 18	18 16				
12	1 1.6	16 12	16 15	18 17	22 20	25 23	28 26						
16	1 1.6	19 17	22 20	30 23	32 26	35 32	38 32						
20	1 1.6	25 22	28 25	38 32	40 32	50 40	60 40						
25	1.2 1.6 3	38 35 30	45 45 12	50 45 40	56 50 45	62 56 52	70 65 50						
28	1.2 1.6 3	45 42 34	54 50 40	60 54 42	68 58 45	84 64 50	98 75 50						
32	1.2 2 3	54 42 38	62 48 42	80 58 46	80 60 52	100 80 60	110 80 70						
40	1.6 2 3	64 56 48	72 64 54	90 80 60	95 80 70	120 100 80	140 110 85						
50	1.6 2 3 4	90 84 70 68	112 98 80 70	125 110 95 80	140 126 110 90	175 150 125 120	220 190 150 140						
60	2 3 4 6	100 100 85 70	120 105 90 80	150 120 100 90	170 130 120 100	220 180 150 130	260 220 190 150						
80	2 3 4 6	165 140 135 120	190 170 150 130	220 185 160 140	240 200 180 160	340 250 220 200	400 320 280 250						

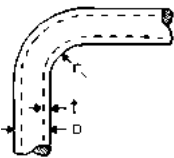


Table adapted from *Aluminium Standards Data and Design – Wrought Products*, Table 3.6, published by the Australian Aluminium Council 2004 and should be used as a guide only.

Where D = outside diameter of tube (mm)
 t = wall thickness of tube (mm)
 r = inside radius of bend (mm)

Note : It is recommended that test bends are carried out before final selection is made.