

# bending aluminium

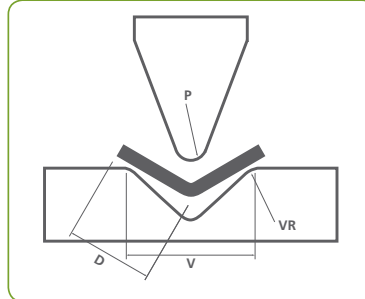
## Press Brake Die Set Up

P = Inside Bend / Punch Tool Radii mm

D = Smallest Setting Side mm

V = Bottom Die V Gap Width mm

VR = Bottom Die V Shoulder Radii mm



### Recommended Press Brake Die Set Up for Cold Forming of Sheet and Plate<sup>1</sup>

P	1.0	1.3	1.6	2.0	2.7	3.0	3.3	4.0	5.0	5.5	6.5	7.0
D	4.0	6.0	7.0	9.0	11.0	13.0	14.0	17.0	22.0	24.0	28.0	31.0
V	6.0	8.0	10.0	12.0	15.0	18.0	20.0	25.0	30.0	35.0	40.0	45.0
VR	0.8	1.0	1.3	1.6	2.2	2.4	2.6	3.2	3.9	4.2	4.9	5.3
P	8.0	10.0	11.0	13.0	16.0	19.0	21.0	23.0	24.5	26.0	28.0	32.0
D	35.0	42.0	47.0	56.0	70.0	80.0	90.0	100.0	105.0	110.0	130.0	140.0
V	50.0	60.0	70.0	80.0	100.0	120.0	130.0	140.0	150.0	160.0	180.0	200.0
VR	5.6	7.0	7.7	9.1	11.2	12.4	13.7	15.0	15.9	16.9	18.2	20.8

1. To select press brake tooling for a bending application refer to the Recommended Minimum Inside Bend Radii chart for the alloy and thickness of metal to be formed. Make sure the Bottom Die V Gap Width V is not less than that recommended above in conjunction with the Punch Tool Radii P.

Using a wider rather than narrower Bottom Die V Gap Width and tooling that is in good condition will reduce the risk of surface marking and cracking. Surface marking on the sheet from the Bottom Die V will indicate less than an optimal tooling configuration.

NALCO recommends that a test bend is made prior to fabrication. Most Press Brake tooling equipment has been designed to bend steel rather than aluminium. Steel has more elongation than aluminium enabling it to be stretched further.

Further technical information can be obtained by contacting your NALCO Account Manager.

## Bend Radii for 90 Degree Cold Forming

Recommended Minimum Inside Bend Radii for 90 Degree Cold Forming of Sheet and Plate, transverse to the rolling direction <sup>1 2 3 4 5 6 7</sup>

Alloys	Tempers	Radii for Various Thicknesses Expressed in Terms of Thickness t							
		0.4mm	0.8mm	1.6mm	3.0mm	4.0mm	6.0mm	10mm	12mm
1100 1200	-0	0	0	0	0	0	½	1	1 ½
	-H12	0	0	0	½	1	1	1 ½	2
	-H14	0	0	0	1	1	1 ½	2	2 ½
	-H16	0	½	1	1 ½				
	-H18	1	1 ½	2	3				
5005 <sup>4</sup>	-0	0	0	0	0	½	1	1	1 ½
	-H12	0	0	0	½	1	1	1 ½	2
	-H14	0	0	0	1	1	1 ½	2	2 ½
	-H16	½	1	1	1 ½				
	-H18	1	1 ½	2	3				
5052 <sup>3 6</sup> 5251	-0	0	0	0	½	1	1	1 ½	1 ½
	-H32	0	0	1	1 ½	1 ½	1 ½	1 ½	2
	-H34	0	1	1 ½	2	2	2 ½	2 ½	3
	-H36	1	1	1 ½	2 ½				
	-H38	1	1 ½	2 ½	3				
5454	-0	0	0	½	1	1	1	1 ½	1 ½
	-H32	0	½	1	1 ½	1 ½	2	2 ½	3 ½
	-H34	½	1	1 ½	2	2 ½	3	3 ½	4
5083 <sup>5</sup>	-0			½	1	1	1	1 ½	1 ½
	-H321		2	2	2	2 ¼	2 ½	3 ½	3 ½
	-H116			2	3	3 ½	4		
6061	-0	0	0	0	1	1	1	1 ½	2
	-T4	0	½	1	1 ½	2 ½	3	3 ½	4
	-T6	1	1	1 ½	2 ½	3	4	4 ½	5

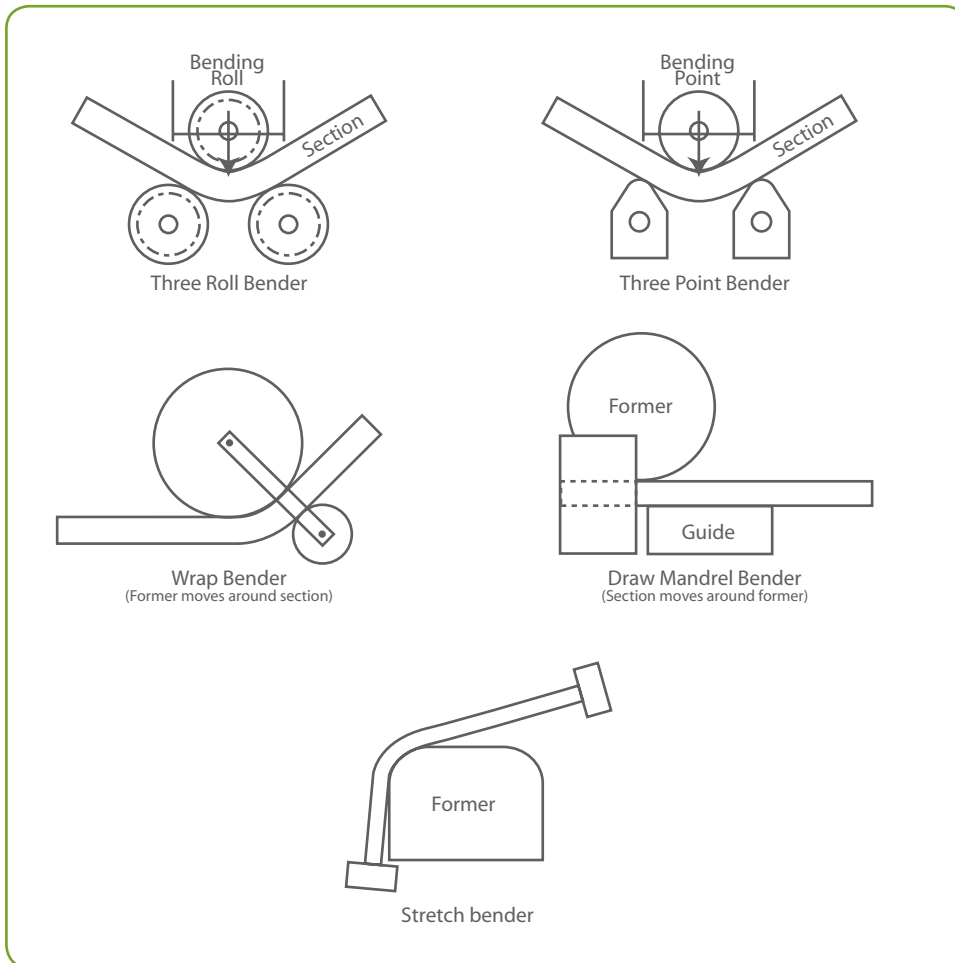
- The radii listed are the minimum recommended for bending sheets and plates without fracturing in a standard press brake with air bend dies. Other types of bending operations may require larger radii or permit smaller radii. The minimum permissible radii will also vary with the design and condition of tooling. Refer to the NALCO Recommended Press Brake Die Set Up Chart for more information.
- Heat-treatable alloys can be formed over appreciably smaller radii immediately after solution heat treatment.
- The H12 temper (applicable to non-heat treatable alloys) is supplied in the as-fabricated condition without special property control but usually can be formed over radii applicable to the H14 (or H34) temper.
- Applicable to 5005 H1X and H3X tempers.
- Use H116 bend radii if yield strength is over 255 MPa or elongation is less than 16%.
- All recommended radii refer to bends made transverse to the rolling direction. A larger radii may be required in some materials for bends made longitudinal to the rolling direction.
- Bend radii for tread plate in temper H112 or H114 should be based on the overall thickness (including lozenge height) of the metal. Then use the bend radii recommended for H34.

# bending aluminium continued...

## Bending Aluminium

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 extruded product.

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.

## Recommended Bending Radii for Round Tube

Recommended Minimum Inside Bending Radii (r) for Selected Sizes of Round Tube - Mandrel Bending

Tube Size		Radii for Various Alloys and Tempers (mm)					
Outside Diameter (mm)	Wall Thickness (mm)	1200-O 1350-O	6106-O, 6060-O 6063-O, 6061-O 6351-O	6106-T4, 6061-T4 6351-T4, 6063-T4	6060-T5 6063-T5 & T6 6101-T5 & T6 6106-T6	6005A-T6 6061-T6 6351-T6	6060-T81 6063-T81
10	1.0	12	15	16	18	20	18
	1.6	10	13	14	16	18	16
12	1.0	16	16	18	22	25	28
	1.6	12	15	17	20	23	26
16	1.0	19	22	30	32	35	38
	1.6	17	20	23	26	32	32
20	1.0	25	28	38	40	50	60
	1.6	22	25	32	32	40	40
25	1.2	38	45	50	56	62	70
	1.6	35	45	46	50	56	65
	3.0	30	42	40	45	52	50
28	1.2	45	54	60	68	84	98
	1.6	42	50	54	58	64	75
	3.0	34	40	42	45	50	50
32	1.2	54	62	80	80	100	110
	2.0	42	48	54	60	80	80
	3.0	38	42	46	52	60	70
40	1.6	64	72	90	95	120	140
	2.0	56	64	80	80	100	110
	3.0	48	54	60	70	80	85
50	1.6	90	112	125	140	175	220
	2.0	84	98	110	126	150	190
	3.0	70	80	95	110	125	150
	4.0	68	70	80	90	120	140
60	2.0	110	120	150	170	220	260
	3.0	100	105	120	130	180	220
	4.0	85	90	100	120	150	190
	6.0	70	80	90	100	130	150
80	2.0	165	190	220	240	340	400
	3.0	140	170	185	200	250	320
	4.0	135	150	160	180	220	280
	6.0	120	130	140	160	200	250

It is recommended that a test bend is carried out before a final selection is made.