



TECHNICAL GUIDE
**BENDING, ROLLING,
SHEARING & PUNCHING**



INTRODUCING OUR NEW PRODUCT NOMENCLATURE

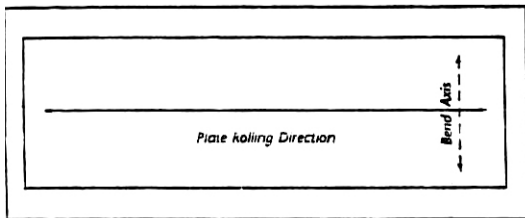
Bisalloy Steels has recently introduced a new product nomenclature. The following table details the grade equivalents.

Note: Only the designation has changed – not the product

Previous Name	New Name
BISPLATE® 60	BISALLOY® Structural 60 steel
BISPLATE® 70	BISALLOY® Structural 70 steel
BISPLATE® 80	BISALLOY® Structural 80 steel
BISPLATE® 100	BISALLOY® Structural 100 steel
BISPLATE® 80PV	BISALLOY® Structural 80 Pressure Vessel steel
BISPLATE® 320	BISALLOY® Wear 320 steel
BISPLATE® 400	BISALLOY® Wear 400 steel
BISPLATE® 450	BISALLOY® Wear 450 steel
BISPLATE® 500	BISALLOY® Wear 500 steel
BISPLATE® 600	BISALLOY® Wear 600 steel
BISPLATE® HIA - Class 2	BISALLOY® Armour RHA300 steel
BISPLATE® HIA - Class 1	BISALLOY® Armour RHA360 steel
BISPLATE® HTA	BISALLOY® Armour HTA400 steel
BISPLATE® UHT	BISALLOY® Armour UHT440 steel
BISPLATE® HHA	BISALLOY® Armour HHA500 steel
BISPLATE® UHH	BISALLOY® Armour UHH600 steel

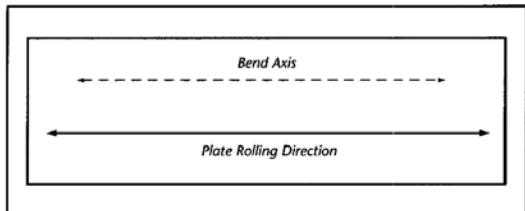
BENDING & ROLLING, FORMING, SHEARING & PUNCHING RECOMMENDATIONS

Fig 1a:



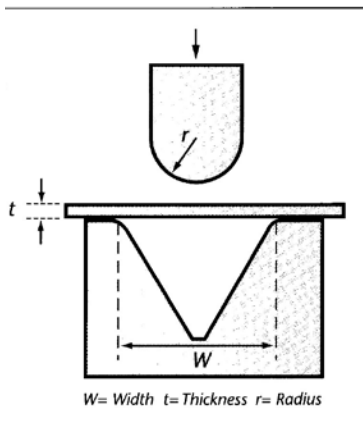
Schematic of transverse bend direction.

Fig 1b:



Schematic of longitudinal bend direction.

Fig 2:



Schematic diagram of brake press bending.

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COLD FORMING

All of the BISALLOY® quenched and tempered steel grades can be cold formed, using brake press bending or plate rolling techniques.

However, with an increase in both hardness and yield stress compared to plain carbon steel grades, suitable consideration of sufficient machine power, plate bending direction and former radii must be made.

In addition, springback allowances should be greater than for plain carbon steel and will depend on the type of forming. Plate edges should be ground smooth, and for thick plates and high hardness grades, the plate edges should be rounded prior to forming.

It is recommended for the high hardness grades that where possible the bend axis be at right angles to the plate rolling direction (transverse bending). For plate 16mm and above in BISALLOY® Wear 500 steel, it is suggested bending be done in the transverse direction only (refer to figure 1a).

MINIMUM FORMER RADII (R) IN MM FOR COLD FORMING

Table 1: The minimum former radii for cold forming of the BISALLOY® steel grades (where possible a larger former radii should be used).

BISALLOY® STEEL GRADE	60		70		80		100, 320, 400		450		500		600	
	T	L	T	L	T	L	T	L	T	L	T	L	T	L
Plate Thickness (t)(mm)														
5	12	12	12	12	12	15	15	20	-	-	-	-	Not generally recommended. Contact Bisalloy Technical Manager if bending is required.	
6	12	15	12	15	15	20	20	25	25	30	30	50		
8	12	16	12	16	20	25	25	35	32	40	40	60		
10	15	20	15	20	25	30	30	45	40	50	50	70		
12	18	24	18	24	30	35	35	55	48	60	60	90		
16	24	32	24	32	45	50	50	75	64	80	85	120		
20	40	50	40	50	65	80	90	110	100	120	130	160		
25	50	62	50	62	75	100	125	150	125	150	170	-		
32	64	80	80	95	110	130	150	190	160	190	250	-		
40	100	120	110	130	140	160	200	250	200	250	-	-		
50	140	190	150	200	175	225	250	-	250	300	-	-		

T: Transverse Bending Direction (refer to fig 1a).
L: Longitudinal Bending Direction (refer to fig 1b).

Notes re: Table 1

- Above values were determined for plate at a temperature of 20°C. If minimum former radii values are to be used, plate temperature should be at least 20°C, maximum 100°C. If forming at a temperature less than 20°C, an increase in former radii is recommended.
- When pressing is being done in a single pass operation, an increase in former radii of minimum 50% must be made.
- When forming using these minimum former radii, flame cut hardened edge (heat affected zone of 1-2mm) should be removed.
- The use of smaller former radii than in the table is not recommended.
- For best cold forming results, ensure adequate lubrication between the plate, die and former.

Table 2: Approximate Bending Force (P) Required for BISALLOY® steel Grades, Compared to Plain Carbon Steel, for a Given Forming Geometry (refer fig 2)

BISALLOY® STEEL GRADE	BENDING FORCE (P)
AS3678 – Grade 250	P
60	2.0P
70	2.4P
80	2.8P
100	3.0P
320	4.0P
400	5.0P
450	5.2P
500	6.4P

Table 3: Approximate Die Openings (refer fig 2)

BISALLOY® STEEL GRADE	DIE OPENING WIDTH (W/t) RANGE
60	10 - 12
70	10 - 12
80	12 - 14
100	12 - 16
320	12 - 16
400	12 - 16
450	14 - 18
500	16 - 20

These recommendations are based on single step to 90 degree bending.

Table 4: Maximum Thickness for Cold Shearing and Punching

BISALLOY® STEEL GRADE	COLD SHEARING	COLD PUNCHING
60	25mm	12mm
70	25mm	12mm
80	25mm	12mm
100	10mm	6mm
320	10mm	6mm
400	Not recommended	Not recommended
450	Not recommended	Not recommended
500	Not recommended	Not recommended

CAPACITY OF PRESS

All BISALLOY® steel grades have yield and tensile strengths higher than for plain carbon steel.

It is important that the capacity of the machine is suitable, bending press manufacturers provide information on bending loads in relation to V-block opening, plate thickness and steel strength.

Table 2 gives an indication of the approximate bending force required when forming BISALLOY® steel grades, compared to plain carbon steel (e.g. AS3678-Grade 250).

HOT FORMING

Hot forming can be done on BISALLOY® Structural steel grades, however the temperature for these grades must not exceed 570°C.

Hot forming is not recommended for BISALLOY® Wear and BISALLOY® Armour steel grades.

The mechanical properties of BISALLOY® Wear steel will reduce if the steel is heated above 250°C.

SHEARING AND PUNCHING

Shearing and punching of the lower hardness BISALLOY® steel grades can be done successfully, provided a machine of sufficient power and stability is used.

BISALLOY® Structural 60, 70 and 80 steel grades can normally be cold sheared up to 25mm thickness. However, the necessary shearing force is in the order of 2-3 times that required for plain carbon steel grades. The grades of BISALLOY® Wear 400, 450, 500 and 600 steel should not be considered for shearing.

The guillotine blades should be very sharp and set with a clearance of 0.25 to 0.40mm. note, the maximum limiting thickness for cold punching are approximately half the cold shearing values.



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