

## 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

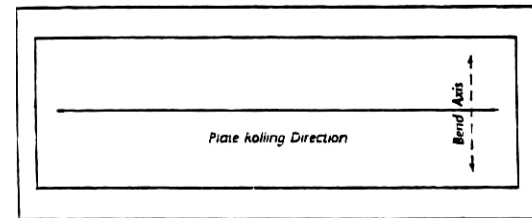
Previous Name	New Name
BISPLATE® 60	BISALLOY® Structural 60 steel
BISPLATE® 70	BISALLOY® Structural 70 steel
BISPLATE® 80	BISALLOY® Structural 80 steel
BISPLATE® 100	BISALLOY® Structural 100 steel
BISPLATE® 80PV	BISALLOY® Structural 80 Pressure Vessel steel
BISPLATE® 320	BISALLOY® Wear 320 steel
BISPLATE® 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 1	BISALLOY® Armour RHA300 steel
BISPLATE® HIA - Class 2	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





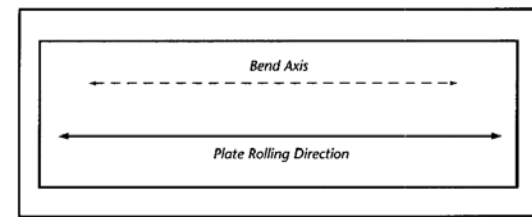
## BENDING & ROLLING, FORMING, SHEARING & PUNCHING RECOMMENDATIONS

Fig 1a:



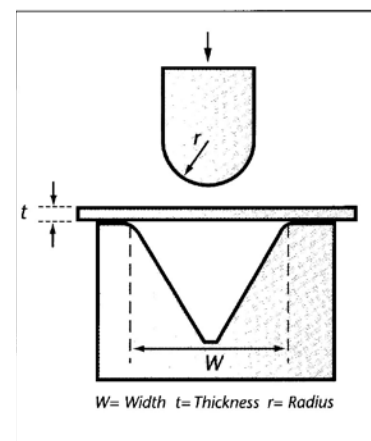
Schematic of transverse bend direction.

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 following gives the minimum former radii for cold forming of the BISALLOY® steel grades (where possible a larger former radii should be used).

Table 1:

BISALLOY® STEEL GRADE	60		70		80		100, 320, 400		450		500		600	
Bend Direction	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	-	-	-	-	-	-
6	12	15	12	15	15	20	20	25	25	30	30	50	25	50
8	12	16	12	16	20	25	25	35	32	40	40	60	40	70
10	15	20	15	20	25	30	30	45	40	50	50	70	50	90
12	18	24	18	24	30	35	35	55	48	60	60	90	60	110
16	24	32	24	32	45	50	50	75	64	80	85	120	85	-
20	40	50	40	50	65	80	90	110	100	120	130	160	100	-
25	50	62	50	62	75	100	125	150	125	150	170	-	150	-
32	64	80	80	95	110	130	150	190	160	190	250	-	250	-
40	100	120	110	130	140	160	200	250	200	240	-	-	-	-
50	140	190	150	200	175	225	300	-	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 30°C. If minimum former radii values are to be used, plate temperature should be at least 30°C, maximum 100°C. If forming at a temperature less than 30°C, an increase in former radii of minimum 50% must be made.
- 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.

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

Table 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
600	-

Approximate Die Openings (refer fig 2)

Table 3:

BISALLOY® STEEL GRADE	W/t TRANSVERSE BENDING	W/t LONGITUDINAL BENDING
60	6.0 - 10.0	7.5 - 12.0
70	6.0 - 10.0	7.5 - 12.0
80	7.0 - 12.0	8.5 - 12.0
100	9.0 - 14.0	9.0 - 15.0
320	9.0 - 14.0	10.0 - 15.0
400	9.0 - 14.0	10.0 - 15.0
450	12.0 - 15.0	12.0 - 16.0
500	14.0 - 18.0	18.0 - 20.0
600	-	-

Maximum Thickness for Cold Shearing and Punching

Table 4:

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
600	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

The operation of hot forming is not recommended for BISALLOY® steel, as hot forming is generally done at a high temperature (900-1000°C) which exceeds the tempering temperature.

As a result, the mechanical properties of quenched and tempered steels will be reduced considerably.

However, if hot forming is unavoidable, it is essential that the component be re-quenched and tempered to restore original mechanical properties.

### 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.