

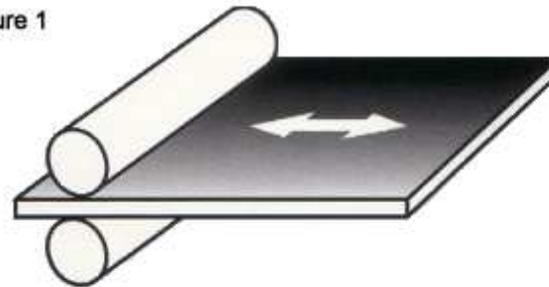


FORMING

COLD FORMING

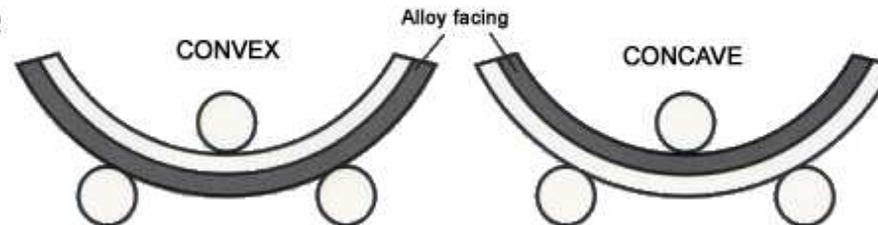
Form only in the direction of the overlay beads.

Figure 1



Whenever possible roll in the direction of the overlay beads.

Figure 2



Convex forming has the effect of increasing and/or widening the stress relief cracks within the alloy facing. Experience shows that this should not present problems if the minimum recommended radius is not exceeded. Above this figure there is an increasing chance of spalling and crack propagation into the carbon steel substrate.

Concave forming puts the alloy facing into compression and the substrate into tension and has the effect on closing the stress relief cracks within the alloy facing. The high compressive strength of the overlay combined with the ductility of the substrate allows far smaller diameters to be formed.

Most standard grades of Triten overlay plate can be cold formed into curved and conical sections using either rolls or press brakes. Thinner and thicker plates (for example Triten T214X) have only limited formability and a number of special chromium/tungsten and tungsten carbide grades can only be used as flat profiles and fabrications (see table and recommendations below).

Typical Radii Achievable – 1000mm long plate

Hardfacing Inside (CONCAVE forming)

Single Layer Deposits	With Beads, as Fig 1
2 on 5	550mm Radius
2 on 5	550mm Radius
4 on 6	300mm Radius
6 on 6	225mm Radius
5 on 8	250mm Radius
6 on 8	225mm Radius
7 on 8	250mm Radius
6 on 10	300mm Radius
9 on 10	850mm Radius
6 on 13	850mm Radius
Double Layer Deposits	
10 on 10	950mm Radius
10 on 15	950mm Radius
Triple Layer Deposits	Not Recommended

Hardfacing Outside (CONVEX forming)

Single Layer Deposits – During forming the cracks will get wider and normally for radii less than 1000mm crack repair may be necessary depending on the application. Crack propagation and eventual fracture of the base material will occur if formed to too small a radius.

Double/Triple Layer Deposits – Not recommended

Note: Direct depositing onto a preformed tube/cone should be considered when hardfacing is required on the external surface.

The above are for guidance only and Triten International Ltd accepts no implied liability for any instances where damage occurs as a result of the above.

Direction of Rolling - Wherever possible plates should be formed with the weld beads aligned in the direction of rolling. (See figure 1).

Minimum Diameters - The minimum recommended diameter to which Triten overlay plate can be formed will depend on the thickness of the plate, the type of substrate and whether the bend is concave (alloy facing on the inside) or convex (alloy facing on the outside). See figure 2.

The table below shows typical minimum diameters for cold forming* T200X plate.

Triten Grades T200X	Nominal Substrate Thicknesses	Minimum Diameter Concave	Minimum Diameter Convex
Single layer overlays from 3.2-6.3mm (1/8"-1/4")	9.5mm (3/8")	400mm (10")	250mm (16")
Double layer overlays from 8.0-12.5mm (5/16"-3/8")	12.5mm (1/2")	450mm (16")	400mm (18")

* At room temperature or with slight pre-heat to 150°C - 200°C (300°F - 400°F)

When using pyramid or pinch rolls, it is recommended that the top roll is protected with a sleeve to prevent damage to the hardfacing. This should be fabricated from 12 mm (1/2") thick carbon steel and sized approximately 50 mm (2") larger than the roll diameter to facilitate installation and removal and to prevent binding. When using a press brake for small diameter pipe, cones and square to round transitions, it is recommended that a hydraulic press is employed for the best results. Forming can be carried out with a male and female die, using a radiused top tool (min. 38cm/ 11/2") over a 'V' block.

HOT FORMING

For thicknesses above 20mm (3/4") forming can be assisted by the application of heat either locally, using a broad flame oxy-gas torch, or generally for larger sections, in a furnace.

To ensure that there are no significant changes in the properties of the plate, hot forming temperatures should not normally exceed 650°C (1,200°F), with furnace soaking times of no more than 1 hour. Higher temperatures may be used in special circumstances.

Hot forming is recommended where 90 degree corners are needed when fabricating square to round transitions.

Special Substrates: Where high strength alloy steel substrates are used, whether in cold or hot forming, more power will be required to form the plate to the same diameters as conventional carbon steel substrates.