



## CYLINDRICAL SHELL COURSES



*Cold forming process by means of the 4-roll bending machine (8.600 t force) of a cylindrical shell-course in steel grade 20 MnMoNi 4-5 to VD TÜV 440-1100 designed for a petrochemical reactor*



Cylindrical shell-courses are basic items entering in a lot of applications such as components for pressure vessels or structural sections.

#### **Manufacturing process**

Shell-courses are produced by cold or hot forming, the choice of the process being a function of both the shell sizes and the material properties. They are preferably supplied fully welded: welding is performed by using either single-electrode, two-electrode or twin-arc submerged arc methods in accordance with the provisions of the relevant international codes, for example AD, ASME (Stamps U, U2 and S are available), PD 5500, CODAP, TRD. Depending on the material and code requirements, the formed parts can be given proper heat treatments, for instance normalising, tempering, water-quenching.

Optionally, the shell-courses are supplied just tack-welded -

achieved from the outside - within the longitudinal joint or braced at both ends by using strong-backs.

As a rule, the plate edges of the longitudinal joint are prepared by a milling process performed from the outside what makes a “narrow gap” weld-joint of 18° achievable. The circular weld-edges of shell-courses are usually produced by flame cutting; edge-machining of shell-courses up to 2.550 mm in length can be agreed.

#### **Scope of supply**

The forming is achieved by means of a 4-roller machine powered with 8.600 t force, designed to deal with 4.300 mm (169,2") wide plate. Its performance includes the cold forming of shell-course up to 240 mm (9,4") in thickness at the full plate width; three interchangeable top rollers (880 mm, 1.200 mm and 1.500 mm) enable to cover a very wide range of diameters.

This machine has been specially engineered for heavy section plates made out of high strength steels characterised by a yield point of 700 MPa. Such an equipment is particularly advantageous for steel grades where hot forming is always problematic e.g. for all steels intended to be delivered either in the water-quenched ( QT ) or in the thermo-mechanically processed ( TM ) condition.

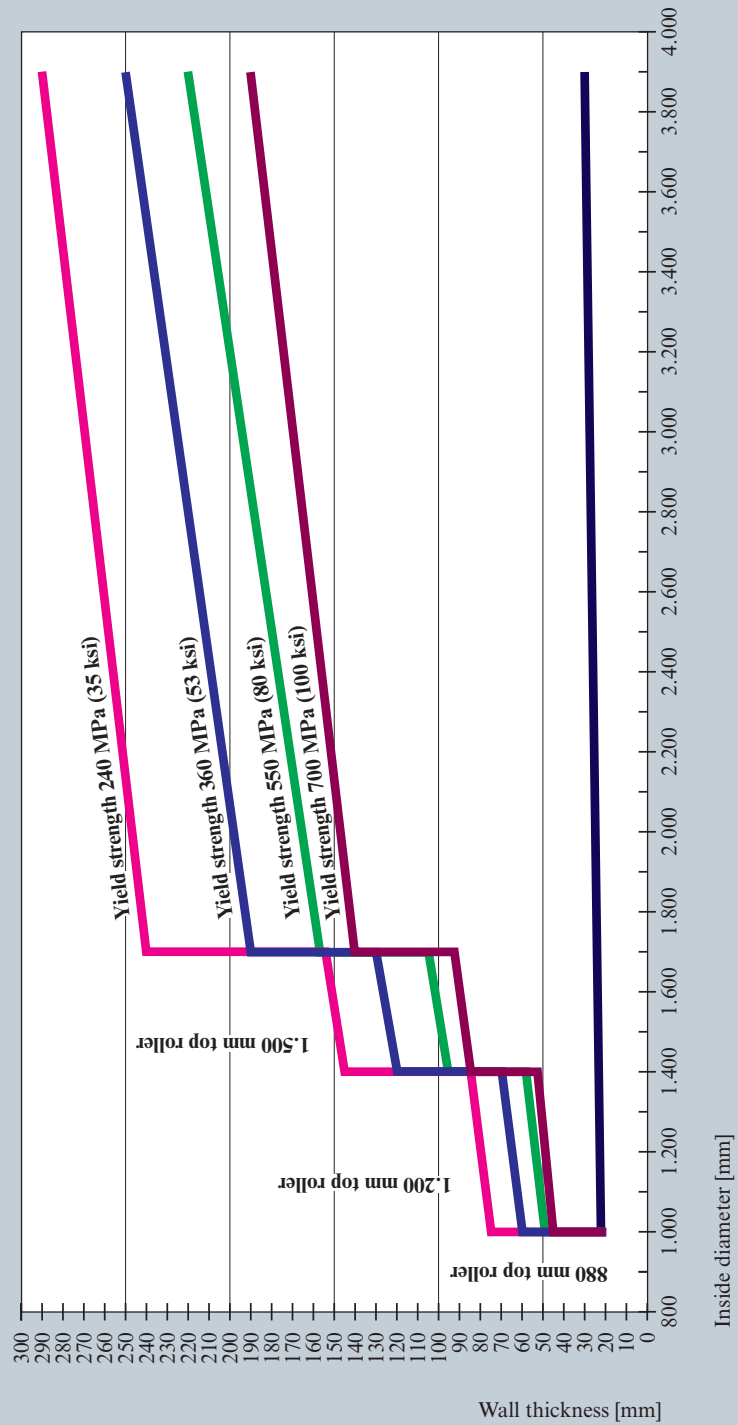
When required the forming can be also performed by using a hot process, conducted in the way to keep extensively the surface finish free of the usual discontinuities resulting from this kind of process.

Please consider also the Technical Delivery Conditions on page 32



### Performance chart of the roll-bending machine

based on a cold forming process up to 4.300 mm (169,2") in course length



Delivery program of shell-courses upon enquiry



### Standard tolerances

Edge-preparation	flame-cut	machined
Bevel angle	$\pm 2.0^\circ$	$\pm 1.0^\circ$
Land position <sup>1)</sup>	$\pm 2.0$ mm	$\pm 1.0$ mm
Land height	$\pm 2.0$ mm	$\pm 1.0$ mm
Root radius <sup>2)</sup>		$\pm 1.0$ mm
Cut-face-quality	ISO 9013-33	ISO 1302-N9

1) measured from the reference diameter  $D_a$  or  $D_i$

2) applicable to U and DU edges only

Diameter <sup>1)</sup>	$\pm 0.3\%$ D
Out-of-roundness <sup>2)</sup>	$\leq 1\%$ D
Length	$\leq 3$ mm
Straightness	$\leq 1$ mm / 1.000 mm

1) calculated from the measured circumference

2) The out of roundness is defined by  $2(D_{max} - D_{min}) / (D_{max} + D_{min})$ .

### Information required

- Diameter  $D_i$  or  $D_a$
- Length L
- Minimum wall thickness after forming s
- Edge-design
- Welding requirements and fabrication code

