

**HOT-ROLLED STEEL PLATES, SHEETS AND COILS**

**Prefabrication, bent plate products**

Bent plate products are components that are ready to be delivered to the installation site, which is beneficial in terms of schedule as well as transport and storing costs. If needed, the products can also be ordered as shop-primed, furnished with welding bevels, and cut to shape. Premarked matchmarks facilitate installation.

### ● Applications

- Tanks
- Pulp silos
- Thick-walled pipes
- Debarking drums
- Furnace jackets
- Pressure equipment
- Shipbuilding
- Offshore structures
- Processing equipment for the wood processing industry

### ● Product types, dimensional ranges and steel grades

The dimensional ranges of bent plate products are determined by the performance values of bending equipment. In this case the steel strength is the most influential. Table 1 shows the thickness ranges and bending radii for the most important types of bent plate products. The widest thickness range is available for steels with the yield strength class  $R_{eH} = 235$  MPa and 355 MPa.

The steel grade range is based on Ruukki's heavy plate production programme with its tolerances. The minimum weight of the heavy plate to be bent is 2000 - 5000 kg, depending of the plate thickness. In addition to this, on request our customers can also choose other materials and dimensional ranges.

### ● Tolerances

Bent plates, segmental plates:

- plate width 1.5 mm
- plate length 2.0 mm
- cross-measure difference, machined bevel < 3 mm
- cross-measure difference, mechanically milled bevel < 4 mm

### A cylinder consisting of two parts i.e. half cylinders, and a cylinder consisting of one part i.e. full cylinders:

Tolerance for roundness  $D_{max} - D_{min}$ :

- maximally 1% from the inner diameter (D)

The greatest allowable deviation from the circumference of the cylinder (length =  $\pi \times D$ ; D = outer diameter):

- 3 mm with an outer diameter of  $D < 1000$
- 0.30% with an outer diameter of  $D \geq 1000$ .

### ● Delivery and inspection document

Bending adds two (2) weeks to the delivery time compared to the delivery of a basic plate. The acceptance inspection for bent plates for proper dimensions and geometry is carried out at the works. According to the order requirements, a Test Report EN 10204-2.2 or an Inspection Certificate EN 10204-3.1 are granted to bent plate products.

### ● Measuring practice and dimension report

For the bent plate products, the appropriate dimensions are verified in the following way and documented in the Dimension Report.

- Full cylinders: Circumference and cross-measure are measured in flat state. Roundness is measured from both ends of the cylinder.
- Half cylinders: Circumference and cross-measure are measured in flat state. Span is measured from both ends.
- Segmental plates: Width, length and cross-measure.

The plate is bent to the nominal radius so that a maximum of 3 mm clearance is left between a 1.2 m long template and the surface of the bent plate, picture on the next page. The Dimension Report will be delivered to the customer upon separate request.

### ● Cylinder manufacture

- Cylinders are tack welded after bending.
- The welding process is MAG flux-cored arc welding (136 EN ISO 4063).
- The filler wire for welding is EN 758 - T 42 6 2Ni M M 2 H10 (such as, OK Tubrod 14.04, ESAB).
- The work is carried out in accordance with the Welding Procedure Specification (WPS).

- The required welding class is C in accordance with Standard EN ISO 5817.

Prior to bending, plates over 40 mm thick are shotblasted to Sa 2 1/2 in accordance with ISO 8501-1.

No guarantee on roundness can be given to cylinders of less than 12 mm wall thickness, or segmental plates of less than 8 mm thickness. These restrictions are based on the disproportionate ratio of the plate's dead weight and material stiffness.

**Matters to be taken into account**

- Handling allowances required at the plate ends. The handling allowance requirement is two times 150 to 500 mm depending on plate thickness and steel grade. If the handling allowance is not taken into consideration, a straight length that measures about four times the plate thickness is left at the ends of the bent plate.
- Markings to be made on bent plate products (data sheet 4.3.01). In bending, hard stamp markings and other markings will remain on the concave surface of the plate, unless other agreed.
- Delivery of measuring protocols.

● **Packing**

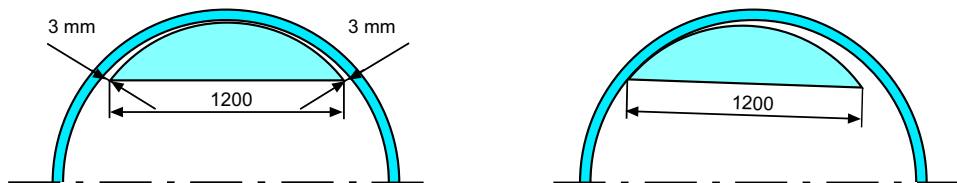
In order to ensure the correct form of cylindrical parts, they can be furnished with transportation supports (the ends are supported by trusses). Bent plates are packed on steel bases. For port handling, the maximum combined gross weight of the steel base and the bent plates is 20 tonnes. The steel base can be used as a transfer base in the ship's hold, on train wagons and on transport vehicles. In this case, bent plates can be packed on the steel base in the form of 10-tonne individual lifts up to a gross weight of 80 tonnes / steel base.

Possible steel bases for plates, and the costs for supporting and special transport, as well as the preparation of trusses for cylinders, will be invoiced separately.

● **Warning**

The steel base itself is not allowed to be used as a lifting accessory, since it has not been manufactured in accordance with the regulations and legislation relating to lifting accessories.

**Figure 1.**  
**A picture of the manner for measuring roundness using a template**



**Table 1.**  
**Bent plate products, thickness ranges and other dimensions**

Bent plate product type	Thickness mm 235 MPa <sup>1)</sup> and 355 MPa <sup>1)</sup>	Thickness mm 420 MPa <sup>1)</sup> and 460 MPa <sup>1)</sup>	Possible values for the bending radius (R) mm
Bent plates, segmental plates	5 – 120	8 – 60	R = 450 or more
Cylinders made of two segmental plates i.e. half cylinders	8 – 40 41 – 120	– 8 – 60	R = 450 – 3000 R = 800 – 3500
Cylinders made of one plate i.e. full cylinders	8 – 40 –	– 8 – 60	R = 450 – 3000 R = 800 – 3500

<sup>1)</sup> The directive yield strength class ( $R_{eH}$ ) of the steel grade to be bent.

The length and width of the plate products to be bent are usually in accordance with the Data Sheet 1.0.02 "Heavy plates, dimensional ranges"; with the maximum width of 3250 mm. However, the plate width is not a restricting factor in bending, even wider plates than this can be bent upon separate request.

Ruukki is a metal expert you can rely on all the way, whenever you need metal based materials, components, systems or total solutions. We constantly develop our product range and operating models to match your needs.

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