

## Rolling mill equipment and rolls. Rolling hardening machines.



The compactness of the rolling hardening machine and its low specific metal consumption is ensured by a design in which the roller sections are composed depending on the thickness and width of the processed sheets and plates, from 3 to 10 independent regarding the units control and drive connected by the single supporting and quickly-assembling frame mounted on the foundation. Each of the mentioned blocks of the rolling hardening machine consists of a lower roller section stationary located on the frame and an upper roller section located in the frame guides and based on the hydraulic-cylinder rods, the bodies of which are pivotally mounted on the base of the frame.

Upstream of the rolling hardening machine, the dual feeding rollers are provided in the separately standing frame and independently controlled by hydraulic and electric drives as well as providing a stable strip feed into the heat treatment zone. Depending on the thickness being processed, the feeding stability of the sheets or plates is regulated in the wide range of speeds (0.03-1.5 m/s) by the independent electric drive of each roller section. At that the rotation of the rollers within each section is carried out through the chain drive.

The synchronization of the rollers rotation speed in the sections is carried out by the automated process control system, which eliminates the defects occurrence on the surface of sheets or plates.

The vertical movement of the upper roller sections and the movable crosshead of the dual feeding rollers is carried out by hydraulic cylinders and controlled by the automated process control system of the rolling hardening machine.

Due to the automated hydraulic drive the following is achieved:

- accuracy of adjustment and keeping of the clearance between the rollers ( $\pm 0.2$  mm);
- insurance of the guaranteed heat treatment of sheets and plates with the thickness from 3 mm to 150 mm with high quality indicators regarding the structure, mechanical properties and flatness;
- protection against breakdowns of the base components of the rolling hardening machine, due to the lifting of the upper roller sections in case of emergency.

The sheet cooling system includes: the pumping station, the equipment for the water-supplying unit with filtration, the flow and cooling control, the manifolds system installed in the inter-roller spaces of the sections.

Distinctive features of the cooling system:

- cooling manifolds grouping into zones of intensive and low-intensive cooling;
- sectional water flow control in the manifolds with individual adjustment in each section;
- use of slotted and special double-chamber manifolds made by NKMZ in the intensive cooling zone.

Distinctive features of the developed machine:

- simple and compact design with high reliability of the base units due to the use of the hydraulic drive for vertical movement of the upper roller sections, precise adjustment of the clearance between the surfaces of the upper and lower section rollers, as well as the regulation of the maximum force impact on the strip;

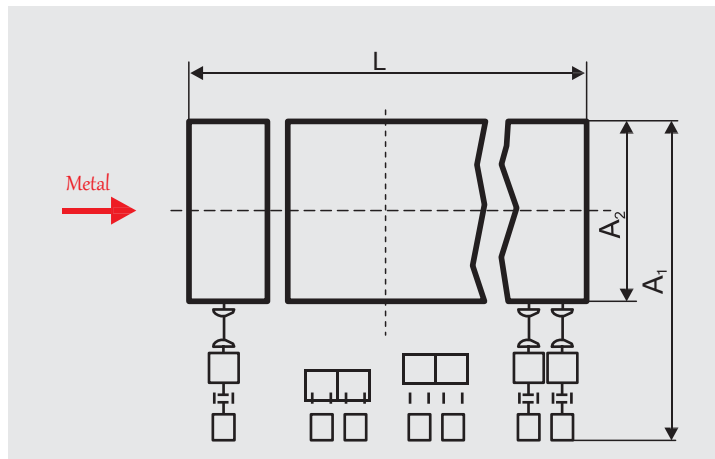
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- highly efficient sheet cooling system with the use of original patented technical solutions;
- integrated technology of sheets and plates heat treatment providing the required structure and parameters for mechanical and geometric parameters in the wide nomenclature range;
- automated control system of the rolling hardening machine with software for the automated working station of the industrial engineer.

The sheets hardening in the rolling hardening machine provides:

- formation of martensitic and martensitic-bainitic structures at the average cooling rate of 5-120°C/s and at the temperature of the sheets or plates downstream of the rolling hardening machine not higher than 50-70°C;
- uniformity of the mechanical properties of the hardened sheet over the sheet area within the fluctuation range of the yield limit  $\pm 15$  MPa (1.5 kg/mm<sup>2</sup>);
- accuracy of mechanical properties obtaining in a batch of sheets  $\pm 20$  MPa (2.0 kg/mm<sup>2</sup>);
- high flatness of hardened sheets or plates in accordance with international standards.

Overall dimensions of the rolling hardening machine in production line



|  |                   | Rolling mill |             |             |             |            |
|--|-------------------|--------------|-------------|-------------|-------------|------------|
|  |                   | 2300         | 2800        | 3000        | 3600        | 5000       |
| Rolle stock overall dimensions               | Thickness, mm     | 3...30       | 8...50      | 8...70      | 8...85      | 4...150    |
|  | Width, mm         | 1000...2150  | 1500...2500 | 1500...2650 | 1250...3000 | 800...4900 |
|  | Length, mm        | 2000-13000   | 4000-12000  | 5000-12000  | 6000-12000  | 5000-13000 |
| Rolling hardening machine overall dimensions | Width (A1/A2), mm | 4400/7300    | 5200/7300   | 5400/7800   | 6100/8400   | 7200/9800  |
|  | Length L, mm      | 10500        | 13500       | 18500       | 18500       | 30000      |
|  | Height, mm        | 3500         | 3500        | 3800        | 3800        | 4500       |

The overall dimensions of the arrangement of the equipment of the pumping station, the water-supplying unit and the control system are designed based on the Customer's conditions.