

Technology and machinery for manufacturing of wooden houses from round wood in Bulgaria

Sotir Glushkov, Vasil Chakarov, Svetozar Madzhov, Ivailo Markoff
Forest Research Institute – Bulgarian Academy of Sciences

INTRODUCTION

Industrial production of log homes from machined milled homes is a recent activity. The first houses were produced in the early 90's of the last century, at the beginning of democratic changes. Their market now shares an amount of 2.1%. Pioneer in their production is the company 'ERATO LOG HOME' - Haskovo but now there are several manufacturers. Houses of this type are exported to almost all European and Arab countries. This construction segment often occurs in winter resorts of Bulgaria as houses, cottages, saunas, catering and even hotels but their owning still is a luxury.

The aim of the study is monitoring of technology for production of round milled beams with the new Bulgarian machine OM-350 and its technological and economical indicators: productivity, quality and prices.

Technical characteristics of the machine for cylinder form of logs and beams

Maximum diameter of logs for processing, mm	550
Interval of treatment of materials, mm	160 – 350 (stepless)
Length range of processed beams, mm	2 000 – 6 000 (stepless)
Interval feed rate, m/min	1,5-3,5 (stepless)
Speed of rotation of beam, min ⁻¹	30 – 80 (stepless)
Speed of rotation of mills, min ⁻¹	4 000
Installed capacity, kW	33
Maximum input power, kW	18
Length, mm	8 800
Width, mm	1 300
Height, mm	1 600
Weight, kg	2 500



Technology the production of round milled beams with diameter 22 cm

Raw material for production. For the production of wooden houses was used coniferous wood of spruce (*Picea abies* Karst.) and fir (*Picea abies* Mill.), as optimal diameter in the thin end being 26 cm. It was necessary to meet the following requirements to logs:

- Maximum difference in diameter 1 cm / 1 m
- Do not have an elliptical section
- Not to have curves
- Not to be a part of a tree stump
- Not to have a dual core
- Not to have any visible wounds of frost, rodents, carpenter ants, ants
- Without stem rot

Workflow processing logs:

1. **sawing.** Logs with a diameter at the small end of 24 to 26 cm are processed on a horizontal band saw in size 24/24 cm.
2. **shaping with a lathe.** Logs with a diameter of 24 cm and square beams 24/24 cm are rounded on a lathe OM-350, by performing the following operations:
 - Roughly rounding of logs/ beams to a diameter of 22.5 cm
 - Fine rounding of logs/ beams to a diameter of 22.0 cm
 - Making longitudinal channels with a length of 13.2 cm
 - Production of angular grooves
 - Making channel to remove internal stresses
 - Edging of finished external rounded beams on their outer size;
 - Impregnation against bruising with detergent ANTI BLUE SELEKT by the method of spraying
 - Labelling, sorting and packaging the finished rounded beams on walls

№	Average duration of operations	Average duration of operations	
		4 m	5 m
1	Transporting square beam to machine with forklift (s)	125	
2	Beam alignment and adjustment of milling heads (s)	158	
3	Rounding of beam (s)	312	382
4	Stopping and adjusting of channel milling head - circular saw (s)	172	
5	Routing of semicircular longitudinal channel and simultaneous cutting of longitudinal compensation channel (s)	312	382
6	Stopping the machine and removing the finished round beam (s)	118	



Roughly rounding



Fine rounding



Channel mill



Disk saw



Profile of rounded beam

CONCLUSIONS

- The duration of operations No 3 and No 5 do not depend on the human factor but only on the sharpness of cutting blades. Other operations exclusively depend on the professional skills of working team.
- The average duration of rounding of 4 m beam is 19 min and 57 sec, and of 5 m beam is respectively 22 minutes and 17 seconds. Machine productivity of an 8 h shift is 18 pieces of 4 m beams or 72 linear m; in the process of rounding of 5 meter beams the productivity is 16 beams or 80 linear meters.
- The coefficient of working time utilization is 72%.
- The price of a meter impregnated spruce rounded beam is 7.40 euro excluding VAT.
- As an outcome of the study, the average prices for a square meter of single floor building in 2014 in Bulgaria depending on the total build-up area were calculated between 380 and 440 Euros among prefabricated log homes manufacturers.