



## MEASURING THE TEMPERATURE OF A BANDSAW BLADE AT SAWING ON A HORIZONTAL LOG BANDSAW

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### Abstract

*The paper presents results of measurements of surface temperatures of bandsaw blades of a horizontal log bandsaw. Methods of measurements are described including sensors used. In another part, results are given of the measurement of surface temperatures of a bandsaw blade in various places and at the various thickness of cutting material.*

**Key words:** *bandsaw blade, temperature, heating*

### INTRODUCTION

Energy supplied to a cutting tool largely changes to heat. The amount of developed heat and its subsequent distribution is dependent on material, tool geometry and condition, cutting conditions, tree species and its moisture as well as on the machine construction. The objective of our experiments is to test the potential use of contactless thermometers as a diagnostic tool of the operation conditions of log bandsaws.

### METHODS OF MEASUREMENT

For the contactless measurements of temperature, Omega OS 1551A-200 sensors were used with the temperature range of 0°C to 200°C and Omega OS 101 with the temperature range -18°C to 548°C. For the digitalization of measured data, a Tedia UDAQ-1416A data logger was used. To evaluate and archive measured data, ScopeWin32 software was used and MS Excel spreadsheet program. The measuring stand consists of a mobile band saw Husqvarna SMB 70 completed by holders of sensors used. A view of the experimental stand with set up sensors is given in Fig. 1.

For this experiment, willow of the absolute moisture content 60% was selected, the sample with 0 to 200 mm and length 1.8 m.

The sensor OS 101 is more suitable in operational conditions on the ground of price and dimensions. The OS 1551 sensor shows better dynamic parameters and accuracy making also possible to set more precisely emissivity of the measured subject. Accuracy of OS 101 is  $\pm 2\%$  of reading or 2.2°C whichever is greater response time is 150 ms. Accuracy of OS 1551 is  $\pm 1\%$  of reading or 1.7°C, response time is 10 ms.

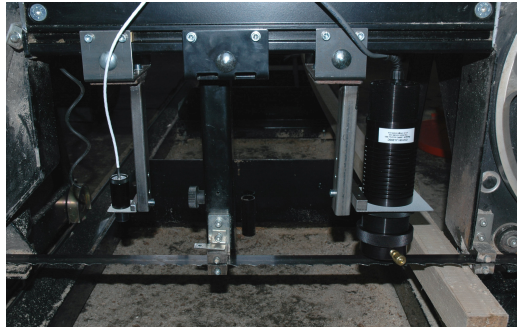


Fig. 1 A view of set up sensors. From the left: OS 101, OS 1551A

## EXPERIMENT

At the experiment, the temperature was taken of a saw band in front of cut and immediately behind the cut. Temperature  $t_1$  is taken by the OS 1551 sensor immediately behind the cut and temperature  $t_2$  by the OS 101 sensor immediately in front of the cut. The measured temperature of both sensors is the mean integral value through the area of a disc of a circular shape of a diameter of 2 cm. A newly sharpened saw band was used. Lower cutting resistance and thus smaller manifestations of warming are expected in the saw band.

The course of temperature during sawing the straight part of a stem of 180 mm cut width is demonstrated in Fig. 2. The course of temperatures shows slight warming the saw band (by 10°C), maximum temperature of the saw band behind cut reached 37°C. A fact mentioned above is caused by the use of a sharp tool and small speed of feed when the volume of inter-tooth gap is higher the volume of a separate chip per one tooth and, thus, no upsetting of the separate chip occurs in the inter-tooth gap. Another factor affecting the surface temperature of a tool is the species and moisture of cut material. Wood of willow of 60% moisture is used. Thus, better heat removal occurs from the tool as against wood of low moisture.

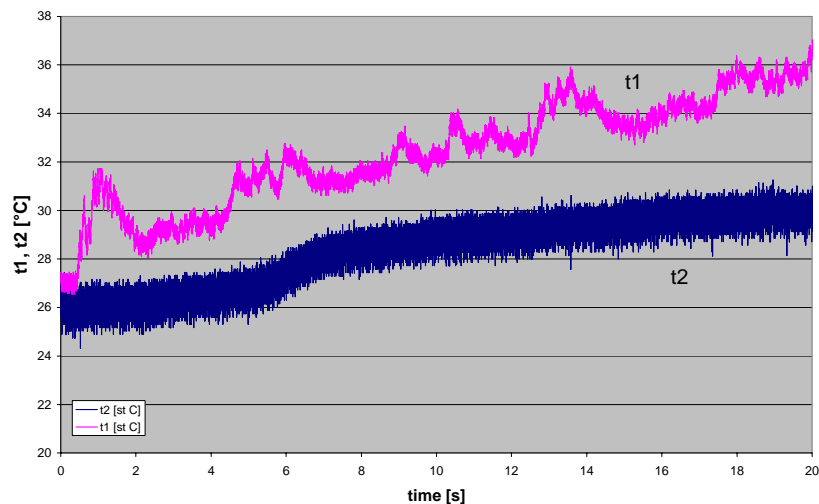


Fig. 2 Development of temperatures at sawing a board 180 mm wide

Another removal of heat from the saw band occurs by convection to the surrounding environment, which is given by the speed of the saw band movement (air) and conduction thanks to the thermal contact between the saw band and the moving wheel. The way of the heat transfer mentioned above is given by heat conductivity and heat capacity of the material of moving wheels. In Fig. 2, just this heat capacity of moving wheels causes delay in the increase of temperature  $t_2$  behind  $t_1$ .

At the smaller width of cut material and otherwise identical cutting conditions, smaller warming of the saw band occurs thanks to the smaller friction between the tool and a workpiece. Likewise, the smaller amount of chips is produced per one tooth of the tool. The fact mentioned above is best demonstrated by the measurement of temperatures in the course of cutting-off a dog board from a log. Data measured at this cut are depicted in Fig. 3. Width of the sawn material is very different, which is given by the stem curvature. The shape of a cut-off dog board is given in Fig. 3 in parallel with measured temperatures at sawing in the given place.

The saw band temperature increases behind cut  $t_1$  with the increasing width of sawn material. The saw band temperature in front of the cut  $t_2$  remains constant. The small amount of heat developed per one revolution of the saw band is sufficiently led away outside the machine. The experiment corroborates a statement mentioned above on the effect of the cut material width on warming the saw band. Moreover, sufficient sensitivity of the  $t_1$  sensor to temperature changes is evident.

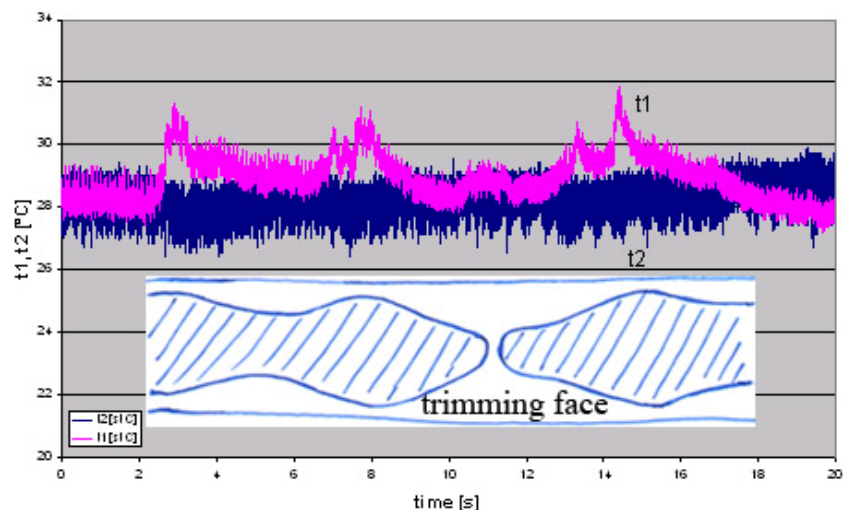


Fig. 3 Development of temperatures in the course of cutting-off a dog board

## CONCLUSION

The carried out experiments proved dependence of the saw band temperature on the sawn material with. Moreover, the different course of temperatures during time was demonstrated on various places of the saw band. The saw band temperature is dependent on a tool, cutting parameters, machined material and the actual machine. Referred to data are results of the first experiments carried out on a newly constructed stand. In our follow-up work, we are going to concentrate on the evaluation of temperatures for various cutting

parameters, tool conditions, various tree species and moisture. On the basis of processing measured data it will be possible to carry out specific changes. We suppose creation of an information database and on the basis of this database it will be possible to carry out diagnostics of log bandsaws through sensing the saw band temperatures.

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