

# Experimental Investigation of Heat Transfer Over Machining Surfaces Using Infrared Camera

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## ABSTRACT

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Steam boiler is used mainly in palm oil mill to generate steam to produce electricity and for sterilization process. An important role of boiler tube heating system is played by forced and natural convection. The type of material and its surface roughness are important to determine the heat transfer rate. This research presents an experimental investigation by infrared thermography of heat transfer over machining surfaces. The overall objective would be to gather temperature gradient of machined surface by using infrared camera and analyses the rate of heat transfer of the machined surface. Three types of material was used for this experiment will be low alloy steel, carbon steel and stainless steel. The steel plates were milled to different surface roughness by varying the spindle speed of 1000 rpm and 1500 rpm. The roughness was measured before the heating process. Then, the material was heated up to 300°C and the natural and force convection experiment was conducted. For force convection, the wind speed was varied from 2.3m/s, 4.1 m/s and 5.2 m/s. As for the natural convection, stainless steel's final heat transfer rate for smooth surface is having variation of 7.24 Watt; manufacturing surface of stainless steel is having variation of 6.2 Watt while the rate of heat transfer for rough surface is having variation of 4.01 Watt. As for the force convection at 5.2 m/s, stainless steel's smooth surfaces final heat transfer rate for smooth surface is having variation of 26.3 Watt, while manufacturing surfaces final heat transfer rate is having variation of 22.81 Watt and the rough surfaces is having final heat transfer rate is having the variation of 21.51 Watt. As to conclude for both natural and force convection, smooth surfaces for all three types of material which consist of carbon steel, low alloy steel and stainless steel has the highest heat transfer rate. In this experiment it could be concluded that smooth surfaces of stainless steel have the highest transfer rate in both natural and force convection.