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# FACULTY OF ENGINEERING

## DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

# DESIGN AND FABRICATION OF A MOTORIZED WOOD LOADER INTO A WOOD BASED BOILER

**BY**

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**DESIGN PROJECT SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD OF BACHELOR'S DEGREE IN AGRICULTURAL MECHANISATION AND IRRIGATION ENGINEERING BUSITEMA UNIVERSITY.**

**DATE: …….**

## ABSTRACT

This report contains three chapters namely; introduction, literature review and methodology.

Chapter one covers the background of boilers in the world and Uganda in particular, the problem statement, the objectives of the project, the reasons as to why the project should be carried on, giving its purpose and finally the scope of the project.

Chapter two talks about the boiler profile, operation of boilers, types of boilers, an overview on the already existing wood loading methods and a reflection on the proposed design.

Chapter three includes the engineering methods that will be used in designing the various machine components of the wood loading machine, how the different machine components will be fabricated and assembled as a way of achieving the specific objectives.

## DEDICATION

I dedicate this project proposal report to my parents; Mr. Aliganyira Andrew and late Ms. Kabatooro Beatrice who have raised me up, given me financial assistance, parental guidance and counseling plus encouragement in all my academic endeavors.

## ACKNOWLEDGEMENT

I do give great gratitude to my supervisors who have worked tirelessly to see that my final year project becomes successful. May God bless you abundantly.

## DECLARATION

I do hereby declare that this final year project proposal report has been compiled by me and has not been presented to any University or other institution of higher learning for any academic award.

**MWINGANIZA EMMANUEL**

Signature: .....

Date: .....

## APPROVAL

This final year proposal project work has been supervised by;

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# Contents

# CHAPTER ONE

## BACKGROUND

In factory operations, heat is an important ingredient necessary to accomplish a number of operations. Heat is usually generated directly or indirectly. Direct heating methods include; cast-iron stoves, fireplaces, modern space heaters fuelled by gas or electricity, among others whereas indirect methods include water bath, steam heating, among others. Steam heating is predominantly/widely used in food processing industries for boiling, purification, sterilization, among others. Steam is usually generated from a boiler, which converts from liquid (water) to vapor state(Sun, Chen, & Marquez, 2002)

In a conventional steam power plant, a boiler consists of a furnace in which fuel is burned, surfaces to transmit heat from the combustion products to the water, and a space where steam can form and collect. The furnace temperature is around $700^0$C to $800^0$C. They are widely used in small installations to provide power for factory processes. The fuels normally used in boilers include; wood, coal, oil, or natural gas(Maggio & Cacciola, 2012). There are several types of boilers used, which include among other; fire-tube and water-tube. In a fire-tube boiler the water is stored in the main body of the boiler and the hot combustion gases pass through one or several metal tubes that pass through the body of the boiler (Rabaçal, Fernandes, & Costa, 2013). Heat is transferred to the water by conduction from the fire-tube(s) to the surrounding water. Increasing the number of passes that the hot combustion gases make through the boiler enhances heat extraction(Ghorbani & Bazooyar, 2012). Whereas in water-tube boilers the fuel is combusted in a central chamber and the exhaust gases flow around metal tubes that contain the water. Heat transfer to the water-tubes is achieved by radiation from the flames as well as by conduction and convection from the hot combustion gases(Barra & Ellzey, 2004). Low-pressure steam boilers generally produce saturated steam at temperatures of $350^o$F to $400^o$F(U.S. Department of Energy, 2012) . Heating temperature (inside the boiler) is as high as 980-1050 ℃ and boiler outlet temperatures ranging from 260-280 $^0$C with loading capacity ranging from 2t/h to 25t/h (Rashid, Chong, Ramli, Zainura, & Norruwaida, 2013). The human body functions best within a narrow range of internal temperature. This "core" temperature varies from 36°C to 38°C. A worker performing heavy work in a hot environment builds up body heat. Working beyond the core temperatures causes heat stress disorders which range from minor discomforts to life-threatening conditions, such as heat rash, heat cramps, heat exhaustion and

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