DESIGN AND ANALYSIS OF A MODULAR BELT WINDER FOR BELT WIDTH ≤ 2400MM X Ø6 METERS WITH A CARRYING CAPACITY OF 50 TONS

UNDERGRADUATE THESIS

Submitted as one of the requirements to
obtain Sarjana Teknik

By:

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MECHANICAL ENGINEERING STUDY PROGRAM

CIKARANG

JUNE 2025

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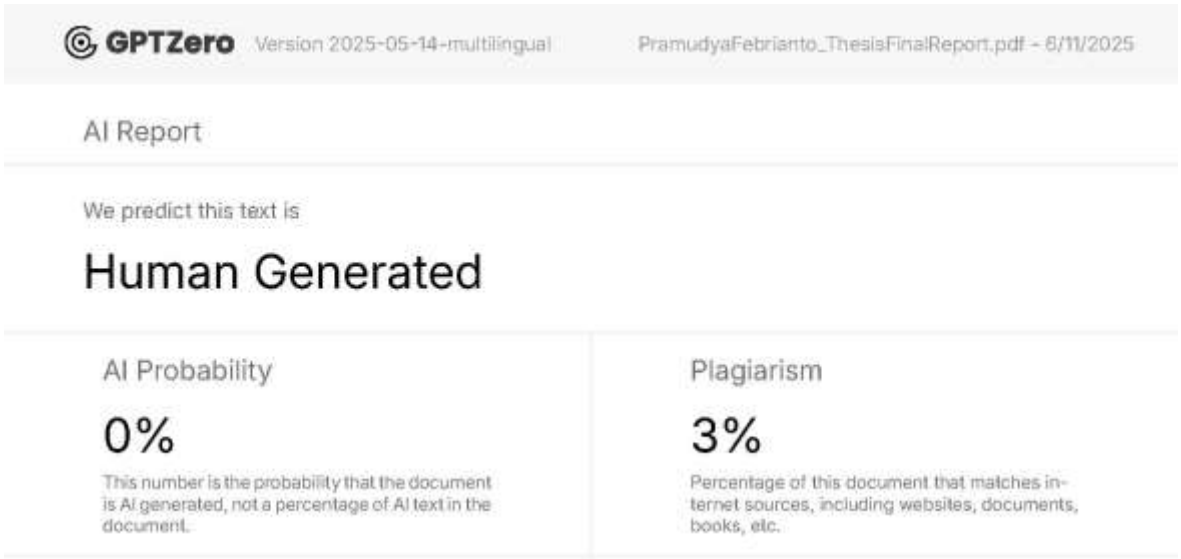

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DESIGN AND ANALYSIS OF A MODULAR BELT WINDER FOR BELT WIDTH 2400MM X Ø6 METERS WITH A CARRYING CAPACITY OF 50 TONS UNDERGRADUATE THESIS Submitted as one of the requirements to obtain Sarjana Teknik By: PRAMUDYA FEBRIANTO 003202305004 FACULTY OF ENGINEERING MECHANICAL ENGINEERING STUDY PROGRAM CIKARANG MAY 2025 ii PANEL OF EXAMINER APPROVAL The Panel of Examiners declare that the undergraduate thesis entitled "DESIGN AND ANALYSIS OF A MODULAR BELT WINDER FOR BELT WIDTH 2400MM X Ø6 METERS WITH A CARRYING CAPACITY OF 50 TONS" that was submitted by Pramudya Febrianto majoring in Mechanical Engineering from the Faculty of Engineering was assessed and approved to have passed the Oral Examination on April 2025 Panel of Examiner ..... Chair of Panel Examiner ..... Examiner I ..... Examiner II iii STATEMENT OF ORIGINALITY In my capacity as an active student of President University and as the author of the undergraduate thesis stated below: Name: Pramudya Febrianto Student ID number: 003202305004 Study Program: Mechanical Engineering Faculty: Engineering I hereby declare that my undergraduate thesis entitled "DESIGN AND ANALYSIS OF A MODULAR BELT WINDER FOR BELT WIDTH 2400MM X Ø6 METERS WITH A CARRYING CAPACITY OF 50 TONS" is, to the best of my knowledge and belief, an original piece of work based on sound academic principles. If there is any plagiarism, including but not limited to Artificial Intelligence plagiarism, is detected in this undergraduate thesis, I am willing to be personally responsible for the consequences of these acts of plagiarism, and accept the sanctions against these acts in accordance with the rules and policies of President University. I also declare that this work, either in whole or in part, has not been submitted to another university to obtain a degree. Cikarang, May 10, 2025 Pramudya Febrianto iv THESIS APPROVAL DESIGN AND ANALYSIS OF A MODULAR BELT WINDER FOR BELT WIDTH 2400MM X Ø6 METERS WITH A CARRYING CAPACITY OF 50 TONS By: PRAMUDYA FEBRIANTO 003202305004 Approved By Dr. Ghany Heryana, S.T, M.T. Dr.Eng. Lydia Anggraini, S.T., M. Eng Thesis Advisor Head of Study Program Mechanical Engineering OR Dean of Faculty of Engineering in case the advisor is Head of Study Program v STATEMENT OF ORIGINALITY In my capacity as an active student of President University and as the author of the undergraduate thesis/final project/business plan (underline that applies) stated below: Name: Pramudya Febrianto Student ID number: 003202305004 Study program: Mechanical Engineering I hereby declare that my undergraduate thesis entitled "DESIGN AND ANALY-

ABSTRACT

Belt conveyors are material transportation systems widely used in the mining, power generation, and manufacturing industries due to their ability to move large quantities of material efficiently and continuously. This system has replaced conventional methods such as haul vehicles, thereby increasing productivity and reducing operational costs. One of the main challenges in operating belt conveyors is the installation and replacement process of the belts, especially for large-sized belts. This process requires specialized tools such as a belt winder, which functions to quickly, safely, and controllably wind and unwind the belt. This study aims to design and analyze a modular belt winder capable of winding and unwinding conveyor belts with widths up to 2400 mm, diameters up to 6 meters, and a maximum load capacity of 50 tons. The design process includes product benchmarking, selection of local materials, and dimension adjustments according to Indonesian land transportation regulations (*Minister of Transportation Regulation No. 60 of 2019*). A structured engineering design approach is applied through conceptual design, initial modeling, and mechanical analysis of key components such as shafts, bearings, gears, drive systems, and supporting structures. The design results show that the belt winder has dimensions in the operational configuration of 5,516 × 5,490 × 3,900 mm and in the transportation configuration of 5,841 × 2,400 × 2,990 mm. All components operate within safe stress limits, with a minimum safety factor of 2 for rotating elements and above 6 for the supporting structure. The torque required to wind a 50-ton load is 31.718,93 N·m, with a pump power of 33.18 kW at 1,272 rpm.

Keywords: Modular Belt Winder, Conveyor Installation, Mechanical Design Analysis

AKNOWLEDGMENT

All praise and gratitude the writer extends to God Almighty for His blessings, grace, and guidance, which have enabled the writer to complete this final project entitled **"Design and Analysis of a Modular Belt Winder for Belt Width ≤ 2400mm x Ø6 Meters with a Carrying Capacity of 50 Tons"** successfully.

This final project is prepared as one of the requirements to obtain a Bachelor's Degree (S1) in the Mechanical Engineering Study Program, Faculty of Engineering, President University.

Throughout the preparation of this project, the writer has received immense support, guidance, and assistance from many parties. Therefore, with deep respect and sincere appreciation, the writer would like to express gratitude to:

1. The writer's mother, beloved wife Gita Zahira, and the entire family for their unconditional love, prayers, and moral support that have consistently strengthened the writer throughout this journey.
2. Dr. Eng. Lydia Anggraini, S.T., M.Eng., as the Head of the Mechanical Engineering Study Program at President University, for her support and the academic facilities provided during the writer's studies.
3. Dr. Ghany Heryana, S.T., M.T., as the thesis supervisor, for his invaluable guidance, insights, and constructive feedback that greatly assisted the completion of this final project.
4. All lecturers of the Mechanical Engineering Study Program at President University for the knowledge, perspective, and inspiration shared throughout the study period, which laid an essential foundation for this project.
5. All colleagues who were involved and contributed technical information, data, and practical insights that greatly supported the design process of this equipment. Their support was instrumental in providing the necessary data for the completion of this final project.
6. Lastly, the writer sincerely thanks all fellow students at President University for their unwavering support and meaningful companionship throughout this academic journey.

DAFTAR ISI

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