

Implementation and Electrical Panel Maintenance Machine Enumerator Rubbish Plastic at TPSA Bagendung - Cilegon

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ABSTRAK

Sampah merupakan salah satu masalah yang sangat krusial jika tidak segera diatasi. Sampah yang tidak dikelola dengan baik dapat mencemari lingkungan, mengancam kesehatan manusia, dan mengganggu keberlanjutan ekosistem. Di tengah meningkatnya jumlah sampah yang dihasilkan oleh masyarakat dan Industri diperlukan tindakan yang konkret dan berkelanjutan untuk mengelolanya. Tujuan kegiatan Pengabdian Kepada Masyarakat (PKM) ini diberikan kepada Tempat Pengelolaan Sampah Akhir (TPSA) Bagendung Cilegon dalam bentuk implementasi dan perawatan panel listrik mesin pencacah sampah plastik. Tema ini dipilih karena melihat kondisi panel listrik yang berada di TPSA, khususnya pada mesin pencacah plastik masih belum sesuai standar instalasi listrik sesuai PUIL2000. Sehingga dari tema ini diharapkan dapat memberikan solusi untuk perawatan panel listrik mesin pencacah sampah plastik sesuai standar PUIL 2000.

Kata kunci: Mesin Pencacah Plastik, Perawatan Panel listrik, Mesin 3 Fasa, TPSA

ABSTRACT

Waste is a very crucial problem if it is not addressed immediately. Waste that is not managed properly can pollute the environment, threaten human health, and disrupt the sustainability of the ecosystem. In the midst of the increasing amount of waste produced by society and industry, concrete and sustainable action is needed to manage it. The aim of this Community Service (PKM) activity was given to the Bagendung Cilegon Final Waste Management Site (TPSA) in the form of implementing and maintaining the electrical panel of the plastic waste shredding machine. This theme was chosen because we saw that the condition of the electrical panels at TPSA, especially the plastic chopping machines, still did not meet the electrical installation standards according to PUIL2000. So it is hoped that this theme can provide a solution for maintaining the electrical panel of plastic waste shredding machines according to PUIL 2000 standards..

Keywords: Machine Enumerator Plastic , Electrical Panel Maintenance , 3 Phase Machines , TPSA

Submit :
18.07.2024

Revised :
16.09.2024

Accepted:
20.10.2024

Available online:
25.11.2024

INTRODUCTION

Cilegon is a city located in the section west Province Banten right at the edge strait Sunda with wide area 162.5 Km². Cilegon have boundaries region as following :

- North : Sea Java
- East : Regency attack
- South : Regency attack
- West : Strait Sunda

Cilegon City Map showed on Figure 1.



Figure 1. Cilegon City Map

In Cilegon City there is various type vital state objects , including ports _ Merak , Harbor Cigading , Krakatau Steel, PLTU Suralaya , PLTU Krakatau Daya Electricity , Krakatoa Tirta Water Industry , Bridges Strait Sunda and Bonded Strait Sunda . With exists vital object _ naturally economy and well-being the people of Cilegon City will increase. Besides impact positive the of course there is also negative impacts caused wrong the only one pile up waste / rubbish .

Waste is a very crucial problem if it is not addressed immediately. Waste that is not managed properly can pollute the environment, threaten human health, and disrupt the sustainability of the ecosystem. In the midst of the increasing amount of waste produced by society and industry, concrete and sustainable action is needed to manage it.

Currently, Cilegon City already has a waste disposal facility that is a model in Indonesia in terms of its management, namely TPA Bagendung. With the existence of this landfill, Cilegon City became the first region in Indonesia to have a Jemputan Solid Fuel (BBJP) waste management factory. The selection of TPSA Bagendung – Cilegon as the project site is based on its role as the main final waste disposal area in the city, which handles a large volume of plastic waste every day. The location provides a realistic environment for implementing and testing the electrical panel maintenance and machine enumerator system due to its existing waste processing infrastructure and frequent technical challenges. In addition, the site's accessibility and support from the local environmental agency make it ideal for conducting practical field implementation and system improvement activities.



Figure 2. TPSA Bagendung Cilegon Work Location

The BBJP Plant Waste Management Factory was built in collaboration between the Cilegon City Government and PT. PLN Persero aims to recycle city waste into something more productive. BBJP Plant TPSA Bagendung will absorb 30 tons of waste every day which will be processed into coal companion fuel or co-firing for the Suralaya Steam Power Plant (PLTU).

In relation to waste recycling, TPSA Bagendung has several shredding machines to be used as waste sorting and shredding media. One of the waste shredding machines can be seen in Figure 3.



Figure 3. Waste Shredding Machine Producing 10 Tons/Day

To support the performance of the chopping machine, the use of electricity and its installation also need to be taken into account. PUIL as the Indonesian National Standard (SNI) with the regulations of the Minister of Energy and Mineral Resources is enforced as a Mandatory SNI (is a regulation), so that it becomes a regulation that must be fulfilled [1]. One of the important factors for fulfilling electrical safety is the installation of electrical installations that meet the provisions regulated in (PUIL). According to IEC 61936 which specifies general requirements for the design and installation of electrical power installations with a nominal voltage above 1kV and a nominal frequency up to 60 Hz, low voltage protection and monitoring systems should be in accordance with PUIL. For industrial scale MCB use, it must meet the applicable standards, namely the IEC 60947-2 series [2] (Ministry of Energy and Mineral Resources, 2014).

Factors that often cause fires in electrical installations are due to insulation failure and poor cable connections, so they need to be avoided because they can threaten the safety of users and equipment [3] (Firmansyah, 2014). To minimize the occurrence of trips and the weakening of components in the chopper machine's electrical installation, this community service program aims to implement and maintain the electrical panel system on the chopper machine. Through this

activity, it is expected that the use of electrical equipment will comply with the applicable national standards, particularly the *Standar Nasional Indonesia (SNI)* for electrical installations—such as SNI IEC 60364 concerning the safety of low-voltage electrical installations. By aligning the system with these standards, the reliability, safety, and efficiency of the chopper machine's operation can be improved.

PROBLEM IDENTIFICATION

From the results of discussions held with partners, information was obtained that on waste shredding machine equipment, MCCB trips often occur when operating the machine with a lot of load (waste) due to the effect of chasing production. Improvements have been made to the MCCB by increasing the power by changing the type of MCCB. to a larger value, but in other cases there are still electrical components that have not been studied further regarding their reliability in use.

So that the waste shredding production machine runs smoothly, the proposing team will install an electrical system that is considered reliable in operating the machine and also provide education regarding maintenance of the electrical system.

IMPLEMENTATION METHOD

1. Problem Solving Framework

The problem solving framework created in this activity includes:

- A. Conduct field observations and interviews to identify problems currently occurring at TPSA Bagendung,
- B. Study literature
- C. Carry out system design
- D. Conduct system trials at TPSA Bagendung
- E. Create outreach materials related to electrical panel maintenance.

2. Activity Method

Based on the problems at TPSA Bagendung, several activities were carried out, including:

- A. First, carry out observations aimed at finding out more detailed problems related to problematic equipment,
- B. Carry out further studies related to literature studies from various reference journals and other electronic media
- C. Purchase materials and tools that are deemed necessary in designing a new system
- D. Carry out a redesign of the electrical system in the electrical panel of the waste chopper machine,
- E. Carry out socialization regarding maintenance of the electrical panel.

3. Decent target

The strategic target audience for this community service is the operator and maintenance of TPSA Bagendung located in Cilego District, Cilegon City, Banten Province.

The flow chart of method can be seen in Figure 4.

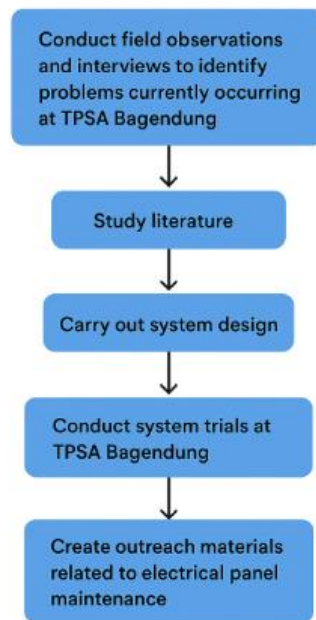


Figure 4. The Flow Chart of Method

RESULTS AND DISCUSSION

A. Preparation

The PKM team in the Petrochemical Industry Instrumentation Technology study program conducted a survey of the TPSA Bagendung location involving several students and TPSA Bagendung stakeholders to conduct a study regarding problems at the TPSA. From the survey results, it was found that there was a problem regarding the condition of the waste shredding machine which often tripped when operating. This machine is used as a plastic goods chopper with a production capacity of 10 tons/day, so if this machine experiences problems it will cause delays in waste production. After further study, the waste shredding machine experienced problems due to poor cleanliness of the panels, some of the cable bolts on the electrical equipment were loose, and the MCCB did not match the function of the machine.



Figure 5. Carrying out A Survey and Study of Problems with Plastic Waste Shredding Machines



Figure 6. Electrical Panel System, Control Panel, Electric Motor

B. Implementation

At the implementation stage, practical training was carried out for technicians at the location of the plastic shredding machine's electrical panel to learn how to maintain and check equipment on the electrical panel as well as cleaning the plastic shredding machine's electrical panel before replacing the MCCB unit (Figure 7). The activity of cleaning of electrical panels and plastic shredding machine control panels can be seen in Figure 8.



Figure 7. Practical Training for Technicians in The Electrical Panel Area



Figure 8. Cleaning of Electrical Panels and Plastic Shredding Machine Control Panels

In accordance with industry standards, the use of MCCBs to supply electricity to machinery also needs to be considered, so that from the results of studies regarding the use of MCCBs, replacements are carried out according to the specifications of the machine used. From the source of the MCCB device provider, a comparison was obtained between the old and new MCCB devices, where the old device used an EasyPact EZC model MCCB device which, judging from the user segment, is not recommended for use in industrial work equipment, so the product specifications were replaced with a Compact NSX MCCB model that suits the needs of the waste shredding machine (Figure 9).

Parameter	Compact NSX	Compact NSXm	EasyPact CVS	EasyPact EZC
Frame size	Two (16-250A and 400-630A)	One (16-160A) DIN rail mounted	Two (16-250A and 400-630A)	Three (100A, 250A and 400-630A)
Customer Segment	All Buildings, Industrial, Infrastructure, Energy, OEMs	Mid-size Buildings, OEMs, Industrial (non-process)	Commercial Buildings, Industrial Buildings (non-process), small OEMs, Retail	Diffuse Retail, small OEMs
Breaking capacity (Icu at 415V AC)	36/50/70/100/150/200kA	16/25/36/50/70kA	25/36/50kA	7.5kA to 50kA
Breaking capacity (Ics at 415V AC)	Ics = 100% x Icu	Ics = 100% x Icu	Ics = 100% x Icu	Ics = 50% x Icu
Operational voltage	Up to 690V AC	Up to 690V AC	220/ 415/440V AC	220/ 415/440V AC
Trip units 100-250A	TMD/TMG/MA/Mic2/5/6 AorE (all with adjustable settings)	TMD (with adjustable settings) ELCB (integral earth leakage)	TMD/MA (all with adjustable settings)	TMD (all with fixed settings)
Trip units 400-630A	Mic2/5/6A or E (all with adjustable settings)	Not applicable	TMD/MA/ETS2.3 (all with adjustable settings)	TMD (all with fixed settings)
Communication option	Yes (with IFM – Modbus or IFE – Ethernet module)	Yes (with Smart Link)	No	No
Versions	Fixed, Plug-in, Withdrawable	Fixed	Fixed	Fixed, Plug-in (upto 250A)
Accessory	Rotary handle/Motor Mechanism/earth-leakage/plug-in	Rotary handle (also side mounted), with EverLink terminals ,	Rotary handle/earth-leakage	Rotary handle/earth-leakage
Certification	IEC, CE, CCC, UL508, Marine, other local, Total Discrimination, Cascading	IEC, CE, CCC, Total Discrimination, Cascading	IEC, CE, CCC, other local	IEC, CE, CCC, UL508**, Marine**, Cascading

Figure 9. Schneider Electric Version MCCB Types [4]

The amount of current used in the MCCB is still adjusted to the old MCCB, namely 100A, considering the use of a motor drive in the waste chopper machine of 42.5A. The Compact NSX model MCCB device has an adjustable current feature which makes it easier to use the MCCB and can adjust the electrical power requirements of the waste chopper machine and also if abnormal conditions occur. Figure 10. shows the process of replacing old MCCB devices to new models



Figure 10. Process of Installing A New MCCB on The Electrical Panel of A Waste Shredder

C. Implementation Results

From the series of preparations to implementation, the final result of the implementation was obtained which was the conclusion of a series of PKM activities, namely signing the handover of goods, implementing the results of teaching to electrical technicians, and implementing and

maintaining the waste chopping machine at TPSA Bagendung. The following is documentation of the results of the activities from the implementation (Figure 11-13).



Figure 11. Handover of Goods for Panel Installation and Maintenance Electricity

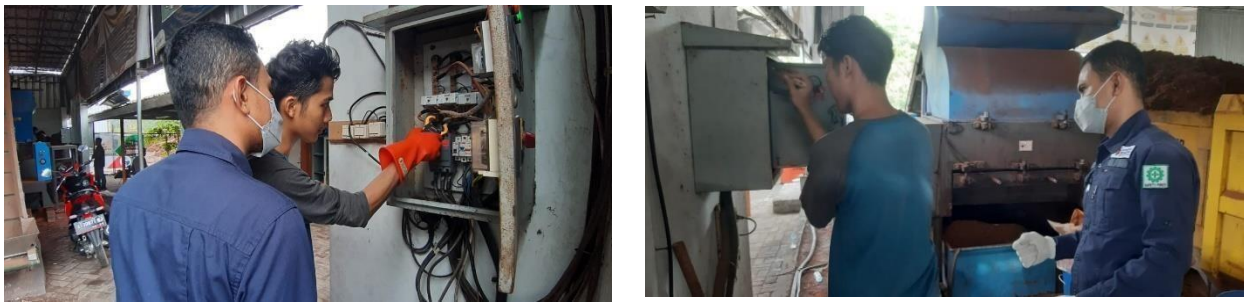


Figure 12. Learning Outcomes For Electrical Technicians At TPA Bagendung



Figure 13. Handover of Documents on Customer Satisfaction Results At TPA Bagendung.

CONCLUSION

The project at TPSA Bagendung – Cilegon successfully improved the performance and safety of the chopper machine through the implementation and maintenance of a standard-compliant electrical panel system. The redesigned system reduced equipment failures and met *Standar Nasional Indonesia (SNI IEC 60364)* requirements. Moreover, the training and outreach activities

enhanced the operators' understanding of proper electrical maintenance, supporting more reliable and sustainable waste management operations.

ACKNOWLEDGMENT

The team would like to express sincere gratitude to the Environmental Agency of Cilegon City (Dinas Lingkungan Hidup Kota Cilegon) and the management and staff of TPSA Bagendung for their support and cooperation throughout the implementation of this community service project.

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