

## ANALISIS PENILAIAN RISIKO PADA LINI PRODUKSI SERAT OPTIK MENGUNAKAN HAZARD IDENTIFICATION RISK ASSESSMENT AND DETERMINING CONTROL (HIRADC)

### *THE ANALYSIS OF RISK ASSESSMENT ON FIBER OPTIC PRODUCTION LINE USING THE HAZARD IDENTIFICATION RISK ASSESSMENT AND DETERMINING CONTROL (HIRADC)*

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#### **ABSTRACT**

*The demand for optical fiber increases to meet the demands of Industry 4.0, companies that manufacture optical fiber must seize this moment to generate profitable business. However, let us not forget how important safety is to all employees working in the fiberglass industry, especially production employees who are directly involved in the fiberglass production process. This study focusses on Risk assessment for patch cords cables production using HIRADC method. The activities of Patch Cord Cable production are divided into 6 steps are striping, curing, trimming, crimping, inspection, packing. Risk assessment in the patch cord production process activities to the packing process by conducting a HIRADC Analysis from determining hazards, potential incidents, to risk ratings. The results of this study obtained additional control for recommended to eliminate the potential for work accidents in the activity Striping, Curing Trimming, Crimping, and Inspection to increase productivity production Cable Fiber Optic (item product: Patch Cord) in PT. JK aligns with SDG 9 that industrialization development can be achieved by improving manufacturing productivity by reducing or eliminating the possibility of occupational accidents.*

**Keywords:** Optical fiber, Risk Assessment, HIRADC, SDG

## **INTRODUCTION**

### **A. Background**

Industrial Era 4.0 has arrived in Indonesia. This new round combines physical, digital, and biological aspects, including the use of artificial intelligence, robotics, and machine learning capabilities. Digitization means anything that was previously analog or has traditionally been technologically restructured to become digital. The definition of digital technology includes the use of large amounts of data (big data), data storage techniques in the cloud (cloud computing), and internet connectivity (internet of things) (Miller, n.d.).

Fiber optic cables are tools that can help support Industry 4.0 challenges. The need for an optimal infrastructure network to support data centers is a cornerstone of Industry 4.0. Fiber optic products enable various sectors in the industry 4.0 era to

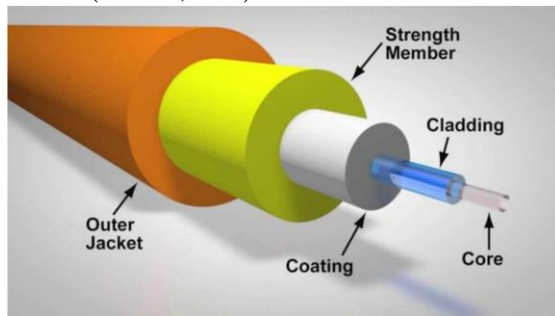
get the right infrastructure support to drive business growth and avoid downtime.

The demand for optical fiber increases to meet the demands of Industry 4.0, companies that manufacture optical fiber must seize this moment to generate profitable business. However, let us not forget how important safety is to all employees working in the fiberglass industry, especially production employees who are directly involved in the fiberglass production process.

### **B. Fiber Optic**

Fiber optic cable is a medium for propagating light. Fiber optic cable harnesses consist of one to several hundred fiber optic strands depending on the type used/selected. Light as an information carrier is reflected within the optical fiber without leaving the path/optical fiber. Light only emerges from the ends of

optical fibers or from cracks in optical fibers (Miller, n.d.).



**Figure 1. Structure Fiber Optic**

The main parts include the following:

1. Core  
This core is the part that transmits light made of glass or plastic. If the larger the core, the lighter can be transmitted into the fiber.
2. Cladding  
Another part of fiber optic is Cladding. This part is in the outer optics surrounding the Core and will later reflect light waves back to the Core.
3. Coating  
This part consists of several layers of plastic that are used to maintain fiber strength, absorb shock, and provide additional protection to the fiber. Where this buffer layer consists of 250 microns to 900 microns whose function is to protect the fiber from the risk of damage and moisture.
4. Outer Jacket  
The outer jacket is the part that serves as a protector. Namely protecting about hundreds to thousands of optical fibers arranged in a fiber optic cable.

Although small fiberglass contains glass material, you still need to be careful of fiberglass fragments. Fiber optic cables travel through the blood to the heart and are therefore dangerous if they enter the body. It is dangerous if a small, smooth, sharp object pierces the heart. Therefore, the manufacturing process of fiber optic cables must consider possible accidents so that they can be managed.

Fiber Optic Tools (Tool Kit) and the functions, there are various kinds of fiber

optic tools that have their respective functions. Here are some of those tools.

- a. Fusion Splicer  
This tool is used to connect optical fiber and a tool used to connect fiber optic cores. Where the fiber in question is made of glass and applies electrical power which is converted into a laser-shaped light media. It is known that this Fusion Splicer has a high enough accuracy to produce perfect splicing.
- b. Stripper  
Fiber optics requires a tool called Stripper which is useful as a tool for cutting and peeling skin and also meat from cables.
- c. Cleaver  
This tool called Cleaver has a function to cut cores. Where when found on the skin of the optical cable you have peeled. To cut it, then you need to use this Cleaver. That way, the glass fiber can be cut neatly.
- d. Optical Fiber Identifier  
For this one tool has a function to be able to find out the direction of the signal with directions and the amount of power that has been passed.

### C. Industry Fiber Optics

PT. JK is a company that manufactures optical fiber cables in Indonesia. Fiber optics are transmission lines made of very thin glass fibers, smaller than a human hair, that can transmit light from one place to another. Fiber optic cables are also made of pure glass and are long, thin, and have a very small diameter (microns). Known for its high-quality products in the market, the company also has expertise in manufacturing different types of optical cables. The production process begins with receiving raw materials from suppliers and then delivering them to the warehouse. After the raw materials pass the test in the quality inspection area, they proceed to the production area. On the production floor, the process of combining multiple materials to form the final product is

followed by a series of tests to check the quality of the product.

#### D. Delimitation of the Problem

This research focuses on the manufacturing process of patch cords, which are fiber optic cables made of glass fiber material. A plug is attached to the end of this cable. This cable is commonly used by data center service providers in Indonesia to connect equipment to telecommunications connections. The advantage of this product is that it can transmit electrical wiring from patch cables quickly, stably, and safely. The size of the cable is thinner than the shield. However, it is possible to send optical signals from one location to another. Generally, patch cords are used for various needs. One of them is the backbone of communication networks. You can connect not only networks of buildings and branches, but also between islands. Patch cables are extremely useful for transmitting millions of pieces of data from building to building, office to office, city to city, and island to island.



Figure 2. Patch Cord

These cables are so-called patch cord cables, which allow you to connect your desktop or a laptop to another device. You can also use patch cords cables to connect servers to structured cable systems or switch ports. Patch cords cable speeds are close to Cat5e, Cat6, and solid UTP in the fiber category. Patch cords cables usually cost more than solid UTP cables or his Box cables.

Flow Process production Cable Fiber Optic (Patch Cord) as follow:

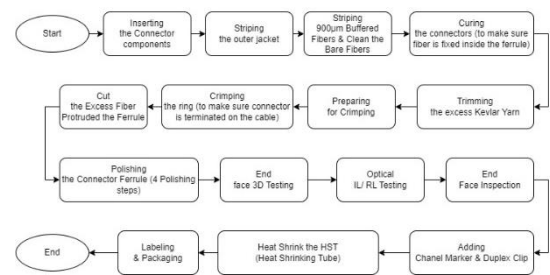


Figure 3. Flow Process Production Patch Cord

#### E. Sustainable Development Goals (SDGs)

The SDGs are a sustainable development program developed by the United Nations (UN) and agreed to by member countries in 2015. Its aim is to promote change based on human rights and equal social, economic, and environmental development. The SDGs have 17 goals and 169 targets to be achieved by 2030. In other words, SDGs are sustainable development challenges at the global level to realize a prosperous and peaceful society while protecting the earth. According to the National Development Planning Agency website, the SDGs are a global and national initiative to improve the well-being of societies. The SDGs have been adopted by all United Nations member states for the peace and prosperity of people and the planet.



Figure 4. Sustainable Development Goals

#### RESEARCH METHODE

This article is based on a data collection method that observes the production line activities of a patch cable manufacturing process. The process of research method analysis of fiberglass

occupational safety risks in production line (Fernando et al., n.d.; Haristama et al., 2023) is as follows:

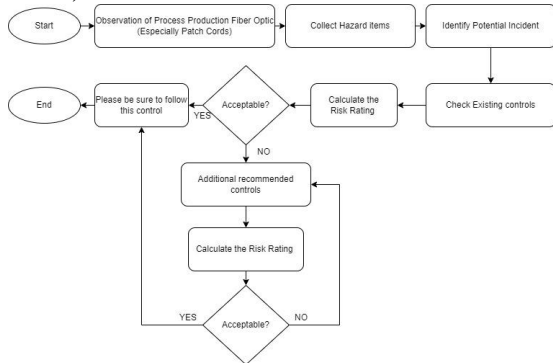


Figure 5. The Process of Research Method

RESULTS AND ANALYSIS

A. HIRADC

The activities of Patch Cord Cable production are divided into 6 steps are stripping, curing, trimming, crimping, inspection, packing. Risk assessment in the patch cord production process activities to the packing process by conducting a HIRADC Analysis from determining hazards, potential incidents, to risk ratings (Nurraudah et al., 2023; Soesilo, n.d.). Where the overall result can be seen as follows.

Table 1. HIRADC Analysis for Patch Cord Production

No	Activity / Product / Services	Hazard / Accident	Incident / Potential Incident	Severity	Probability	Risk Rating	Additional controls (recommended)	Consequence	Probability	Risk Rating	Acceptable?	Remarks / Keterangan
1	Stripping (the process of stripping fiber optic cables to expose the optical core using a tool called a stripper)	Electric shock	Electric shock	3	2	6	Ventilasi yang memadai di ruang kerja untuk mengurangi debu serat optik	2	2	4	Y	
2	Curing (the process of drying a polymer layer to strengthen the cable and maintain its strength)	Eye irritation	Eye irritation	2	1	2	Implementasi praktik daur ulang dan pengolahan limbah yang tepat	2	2	4	Y	
3	Trimming (the process of cutting the ends of optical fibers to ensure the precision of the length and quality of the optical joint)	Eye irritation	Eye irritation	2	1	2	Penempatan peringatan visual dan pelatihan operator tentang bahaya paparan sinar UV	2	1	2	Y	
4	Crimping (the process of mounting connectors on the ends of optical fibers using high pressure to secure the optical connection)	Eye irritation	Eye irritation	2	1	2	Penempatan peringatan visual tentang bahaya paparan serat optik	2	2	4	Y	
5	Inspection (vision inspection process and testing to ensure the quality of fiber optics, connectors and joints according to industry standards)	Eye irritation	Eye irritation	2	1	2	Penggunaan peralatan pemotong yang dirancang dengan keamanan tinggi dan dilengkapi dengan pelindung	2	2	4	Y	
6	Packing (The Goods process securely wrapped for delivery to customer or distributor)	Eye irritation	Eye irritation	2	1	2	Penggunaan peringatan visual tentang bahaya paparan serat optik	2	1	2	Y	

B. Sustainable Development Goals (SDGs)

In line with Indonesia's 2030 SDGs roadmap, this article aligns with SDG 9 that industrialization development can be achieved by improving manufacturing productivity by reducing or eliminating the

possibility of occupational accidents. This study focusses to risk assessment to prevent or even eliminate the occurrence of industrial accidents and improve productivity, thereby indirectly supporting Indonesia's SDGs activities

CONCLUSION

The results of this study obtained additional control for recommended to eliminate the potential for work accidents in the activity Stripping, Curing Trimming, Crimping, and Inspection to increase productivity production Cable Fiber Optic (Patch Cord) in PT. JK aligns with SDG 9 that industrialization development can be achieved by improving manufacturing productivity by reducing or eliminating the possibility of occupational accidents (Putri et al., n.d.; Rotinsulu et al., 2023), can be seen as follows.

Table 2. Item Control Recommended by HIRADC

No	Activity / Product / Services	Additional controls (recommended)	Consequence	Probability	Risk Rating	Acceptable?	Remarks / Keterangan
1	Stripping (the process of stripping fiber optic cables to expose the optical core using a tool called a stripper)	Ventilasi yang memadai di ruang kerja untuk mengurangi debu serat optik	2	2	4	Y	
2	Curing (the process of drying a polymer layer to strengthen the cable and maintain its strength)	Implementasi praktik daur ulang dan pengolahan limbah yang tepat	2	2	4	Y	
3	Trimming (the process of cutting the ends of optical fibers to ensure the precision of the length and quality of the optical joint)	Penempatan peringatan visual dan pelatihan operator tentang bahaya paparan sinar UV	2	1	2	Y	
4	Crimping (the process of mounting connectors on the ends of optical fibers using high pressure to secure the optical connection)	Penempatan peringatan visual tentang bahaya paparan serat optik	2	2	4	Y	
5	Inspection (vision inspection process and testing to ensure the quality of fiber optics, connectors and joints according to industry standards)	Penggunaan peralatan pemotong yang dirancang dengan keamanan tinggi dan dilengkapi dengan pelindung	2	2	4	Y	
6	Packing (The Goods process securely wrapped for delivery to customer or distributor)	Penggunaan peringatan visual tentang bahaya paparan serat optik	2	1	2	Y	

REFERENCES

Ahmad, F. (2022). Implementation of Occupational Safety and Health (K3) for Increasing Employee Productivity. Jurnal Economic Resources, 5(2).

Aven, T. (2015). Risk analysis. Ottawa, Canada : John Wiley & Sons

- Fernando, B., Felicia, A., Yakup, W., Gozali, L., & Ali, A. (n.d.). *Safety Risk Management Analysis At PT. XYZ Using The HIRADC And FMEA Approach*.
- Haristama, I. S., Zacob, A., & Susanti, L. (2023). Risk Analysis of Occupational Hazards Using HIRADC Approach in the Implementation of Occupational Safety and Health Management System. *Journal of Engineering Research and Reports*, 25(6), 28–39. doi: 10.9734/jerr/2023/v25i6940
- H. W. Heinrich, 1941. *Industrial Accident Prevention*. McGraw-Hill Book Company, Inc: 464
- Miller, C. M. (n.d.). *A Fiber-Optic-Cable Connector*.
- Nurraudah, R., & Yuamita, F. (2023). Analisis Risiko Potensi Kecelakaan Kerja Pada Pekerja Departemen Persiapan Produksi Menggunakan Metode HIRADC (Hazard Identification, Risk Assesment And Determining Control) (Studi Kasus : PT Mandiri Jogja International). *Jurnal Teknologi Dan Manajemen Industri Terapan (JTMIT)*, 2(3), 159–167.
- Putri, E. Y., & Hasibuan, S. (n.d.). *Implementation of Risk Control Hazards Identification using PDCA Method to Reduce Potential Work Accidents at Tissue Company*.
- OHSAS Hazard Control Hierarchy 18001:2007
- Rotinsulu, F. N. C., Dundu, A. K. T., Malingkas, G. Y., Mondoringin, M. R. I. A., & Thambas, A. H. (2023). RISK POTENTIAL ANALYSIS USING HAZARD IDENTIFICATION, RISK ASSESSMENT AND DETERMINE CONTROL (HIRADC) AND JOB SAFETY ANALYSIS (JSA) METHODS. In *Asian Journal of Engineering, Social and Health* (Vol. 2, Issue 10). Retrieved from <https://ajesh.ph/index.php/gp>
- Soesilo, R. (n.d.). *JSA and HIRADC Analysis Of Mold Replacement Process On Inject Stretch Blow Machine*. doi: 10.52088/ijesty.v1i4.398