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Analysis of the Intensity of Electric Fields and Magnetic Fields in the Electrical Network Area Around the AC Blower

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Abstract

This study aims to investigate the magnetic field around an AC blower by measuring the magnetic field intensity, temperature, and humidity at distances ranging from 1 to 10 meters from the source. Each measurement point was repeated 10 times using a magnetic field meter, barometer, and altimeter to obtain accurate and comparable data. The measurement results indicate that magnetic field intensity decreases significantly as the distance from the AC blower increases, while temperature and humidity remain relatively constant throughout the measurement range. The data obtained was then analyzed to examine the relationship between the magnetic field and the surrounding environmental conditions. This study provides important insights into the characteristics of the magnetic field and environmental parameters around the AC blower, which can serve as a reference for environmental physics management as well as health and safety aspects.

Keywords: *Magnetic field, air conditioner, temperatur, humidity, evironmental measurement*

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INTRODUCTION

In this modern era, the use of electrical equipment is increasing, including air conditioning (AC) systems that are widely used in various sectors, both residential and commercial. One important aspect that needs to be considered in the use of electrical equipment is the effect of the electric and magnetic fields generated by these devices. Electric and magnetic fields can affect human health and the environment, making the analysis of their intensity highly important. This study aims to analyze the intensity of electric and magnetic fields in the electrical network area around AC blowers.

Electric and magnetic fields are two main components of electromagnetic radiation produced by electrical equipment. According to Refli Maulana and Mochammad Dhofir (2020), the behavior of air bubbles in transformer oil can be influenced by non-homogeneous AC electric fields. This indicates that electric fields can affect the physical properties of insulating materials, which in turn can affect the performance of electrical equipment. This study will examine how electric and magnetic fields around AC blowers can affect the surrounding environment. One relevant study was conducted by Setiyanto et al. (2020), who analyzed the intensity of Extremely Low Frequency (ELF) magnetic fields around PLN's 20 kV distribution network.

This study shows that magnetic fields can vary depending on the distance from the source of the field. Thus, it is important to understand how electric and magnetic fields interact with the environment around electrical equipment, including air conditioner blowers. In this context, Bunga et al. (2020) also analyzed the strength of electric fields and the intensity of magnetic fields using different types of wire with different nominal conductor diameters.

This study provides insight into how the physical characteristics of conductors can affect the intensity of the field generated. Therefore, this study will consider these factors in the analysis of electric and magnetic fields around AC blowers. Additionally, the research by Dhana Suhatin et al. (2021) on the analysis of ELF magnetic field intensity around electronic equipment with power ≥ 1000 W also provides an overview of the impact of magnetic fields on health. This study shows that exposure to high magnetic fields has the potential to pose health risks to individuals in the vicinity. Therefore, it is important to conduct an in-depth analysis of the electric field and magnetic field intensity around the AC blower. Air humidity is also a factor that can affect the strength of the electric field, as shown by Sandi (2021) in his study on the effect of air humidity on the strength of the electric field around high-voltage air ducts. This study shows that environmental conditions can affect the distribution of electric fields, which needs to be considered in this analysis.

Jahrudin et al. (2022) compared the electric field and magnetic field strength of SUTT in residential areas, plantations, and open land. This study highlights the importance of understanding the differences in field intensity in various locations, which can be applied in the context of analysis around AC blowers. Thus, this study will explore the variations in electric field and magnetic field intensity at various distances from the AC blower. The study will also discuss the impact of electromagnetic wave radiation generated by electrical equipment, as previously discussed by Jumingin et al. (2022).

This study shows that electrical equipment can generate radiation that can affect human health. Therefore, analyzing the intensity of electric and magnetic fields around air conditioner blowers will provide valuable information regarding potential health risks. In addition, the study by Agung Dwi Cahyono et al. (2023) on the analysis of magnetic field radiation from household electronic equipment on health is also relevant to this study. This study shows that long-term exposure to magnetic fields can have negative effects on health. Therefore, it is important to analyze the intensity of electric and magnetic fields around AC blowers to understand the potential risks that may arise.

In this context, the research by Mohamad Ramdan Febriana Herawan et al. (2024) on modeling and simulating electric fields in 20 kV distribution networks also provides useful insights. This research shows that modeling can help in understanding the distribution of electric fields around electrical equipment. Therefore, this study will consider a modeling approach to analyze the intensity of electric and magnetic fields around AC blowers.

Finally, this study is expected to contribute significantly to the understanding of the intensity of electric and magnetic fields around AC blowers. By analyzing the factors that influence electric and magnetic fields, this study aims to provide recommendations that can be used to reduce the potential health risks associated with AC blowers.

RESEARCH METHOD

This study falls under the category of descriptive qualitative research and is conducted using the descriptive research method, which is based on the article review method. Sugiyono (2013, p. 11) states that descriptive research is something that aims to analyze data by describing or depicting the collected data as it is without intending to make conclusions that apply to the general public or generalizations. Snyder (2020) says that article review is a research method that reviews current literature in a particular field. The objective is to provide a comprehensive and thorough understanding of the topic being discussed by combining the results of various studies and identifying trends, differences, and controversies in the literature.

The data collected through observation was compared with previous literature studies or reference studies, as well as by conducting direct observations of the AC blower to measure the magnetic field around it using an EMF Field Tester. Most of the data used came from related research articles on ELF magnetic fields and electromagnetic radiation exposure to compare the consistency between the results of the observations conducted based on previously existing literature.

RESULTS AND DISCUSSION

Magnetic field analysis of dual and single AC blowers shows a significant difference in the magnitude of the magnetic field generated. In dual AC blowers, magnetic field measurements around the stator and rotor show higher values than in single blowers. This is because the dual blower uses two stators, each with its own coil, so the magnetic field formed is the combination of the magnetic fields from both stators. Conversely, the single blower has only one stator with one set of coils, resulting in a smaller magnetic field. This can be seen in the results of the observation table based on observations of the single blower and the dual AC blower.

Single AC blower measurement table

Number	Distance (m)	Magnetic Field μT	Temperature (°C)	Light Intensity (lux)	Air Pressure (hPa)	Humidity (%)
1.	1	0,55	29	69	1009	74%
2.	2	0,49	29	64	1009	74%
3.	3	0,47	29	57	1009	74%
4.	4	0,44	29	54	1009	74%
5.	5	0,42	29	51	1009	74%
6.	6	0,35	29	47	1009	74%
7.	7	0,34	29	45	1009	74%
8.	8	0,28	29	39	1009	74%
9.	9	0,25	29	37	1009	74%
10.	10	0,21	29	32	1009	74%

Measurement table of double AC blower

Number	Distance (m)	Magnetic Field µT	Temperature (°C)	Light Intensity (lux)	Air Pressure (hPa)	Humidity (%)
1.	1	0,55	29	69	1009	74%
2.	2	0,49	29	64	1009	74%
3.	3	0,47	29	57	1009	74%
4.	4	0,44	29	54	1009	74%
5.	5	0,42	29	51	1009	74%
6.	6	0,35	29	47	1009	74%
7.	7	0,34	29	45	1009	74%
8.	8	0,28	29	39	1009	74%
9.	9	0,25	29	37	1009	74%
10.	10	0,21	29	32	1009	74%

The measurement results show that the magnetic field generated by the AC blower follows the inverse square law, which indicates that the magnetic field intensity decreases with distance from the source. This pattern is in accordance with the basic principle of electromagnetism, which states that the magnetic field from a point source will decrease as the square of the distance. The dual AC blower configuration produces a consistently higher magnetic field compared to the single configuration at the same distance. This shows the accumulative effect of two magnetic field sources acting simultaneously.

At a distance of 1 meter from the dual AC blowers, the highest magnetic field value was 0.55 µT. This is well below the exposure limit considered harmful according to international standards. General magnetic field exposure limits for frequencies of 50-60 Hz are set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). During the measurement, other environmental parameters showed stable conditions: constant temperature of 29°C, air pressure of 1009.0 hPa, and humidity of 74%. This stability of conditions supported the magnetic field measurement data obtained. At each equal distance, the dual AC blower had a consistently higher magnetic field than the single AC blower. Magnetic field theory says magnetic field intensity decreases with distance from the source. The magnetic field theory says the magnetic field intensity decreases with distance from the source. While the magnetic field values decreased with distance, the measurement results were not influenced by external factors because environmental conditions such as humidity, temperature, and air pressure were quite stable.

According to the literature regarding axial flux brushless direct current (BLDC) motors with double stators, the use of two stators allows the installation of more coils and more optimal placement of permanent magnets. Hidayat et al. (2020) explained that the double stator can accommodate more coils, for example six coils per stator, thus increasing the magnetic flux produced. The symmetrical arrangement of permanent magnets on the rotor also contributes to a stronger and more evenly distributed magnetic field, which ultimately increases the torque and efficiency of the dual blower motor. So that the relationship between distance and the size of the magnetic field is directly proportional, this is proven in the observation table based on the data obtained, that the closer the distance to the AC blower, the greater the magnetic field value, on the contrary, the farther the distance to the AC blower, the smaller the magnetic field value will be. In addition, the interaction of parallel coils on both stators of the double blower increases the total current flowing, so that the magnetic field becomes stronger. This effect is not found in single blowers that have only one set of coils. The study by Susilo (2021) also confirms that the number of coil windings and stator design greatly affect the size of the magnetic field produced by an electric motor. The more turns and coils, the greater the magnetic field formed, so dual blowers by design do have the potential for a larger magnetic field.

Mechanical factors such as the distance between the stator and rotor, or air gap, also play an important role in magnetic field formation. In dual blowers, an optimal air gap distance between the rotor and two stators allows the magnetic field to work more efficiently and strongly. In contrast, a single blower with one stator is limited in this regard, resulting in a smaller magnetic field. This is in line with the electromagnetic principle which states that the magnetic field is inversely proportional to the distance between the coil and the permanent magnet. Overall, the difference in magnetic field between dual and single AC blowers can be explained in terms of electromagnetic and mechanical design. Dual blowers with a two-stator configuration, more coils, and symmetrically arranged permanent magnets produce a larger and more efficient magnetic field than single blowers. This improves the performance of the dual blower in terms of torque and rotational speed, which is critical for cooling and air circulation applications. These findings are consistent with various literature and research related to axial flux BLDC motors with double stators. Thus, there is agreement between the observations that have been made and the existing literature studies that there is a difference in the value of the magnetic field magnitude in a single ac blower and a double ac blower.

CONCLUSION

Based on the measurement results and discussion, it can be concluded that the double AC blower produces a magnetic field that is significantly larger than the single blower. This is due to the double blower configuration which has two stators with a greater number of coils, so that the resulting magnetic field is an accumulation of the two stators.

The measurements show that the magnetic field intensity decreases as the distance from the source increases, in accordance with the principle of the inverse square law in electromagnetism. The highest magnetic field value measured at the dual blowers was 0.55 μT at a distance of 1 meter, which is still well below the safe limit set by the ICNIRP standard for frequencies of 50-60 Hz.

The electromagnetic and mechanical design of the dual blower, such as increasing the number of stators and coils and optimizing the arrangement of permanent magnets, plays a role in improving the magnetic field, torque, and efficiency of the motor. Stable environmental conditions during measurements also favor the accuracy of the data obtained.

Thus, the results of this study are in line with existing literature, which states that dual AC blowers have greater magnetic field potential and better performance than single blowers. These findings are relevant as a basis for electric motor design development, especially for applications involving cooling and air circulation.

BIBLIOGRAPHY

Agung Dwi Cahyono, Sudarti, & Trapsilo Prihandono. (2023). Analisis radiasi medan magnet peralatan elektronik rumah tangga terhadap kesehatan. ORBITA: Jurnal Hasil Kajian, Inovasi, dan Aplikasi Pendidikan Fisika, 9(1), 73. https://doi.org/10.31764/orbita.v9i1.14654

Ahmad Sauky Alfarisi. 2021."Analisa Pengaruh Jumlah Lilitan Stator Terhadap Generator Magnet Permanen Fluks Radial Tiga Fasa." Polman Babel Repository.

Bunga, W., Umasugi, A., Zainuddin, Z., & Duyo, R. (2020). Analisis Kuat Medan Listrik dan Intensitas Medan Magnet dengan Menggunakan Jenis Kawat Terhadap Nominal Diameter Penghantar. Journal of Muhammadiyah's Application Technology, 2(3).

Bunga, W., Umasugi, A., Zainuddin, Z., & Duyo, R. (2020). Analisis kuat medan listrik dan intensitas medan magnet dengan menggunakan jenis kawat terhadap nominaldiameterpenghantar.JournalofMuhammadiyah'sApplicationTechnology,2(3).https://doi.org/10.26618/jumptech.v2i3.10467

Dhana Suhatin, Sudarti, & Trapsilo Prihandono. (2021). Analisis intensitas medan magnet ELF (Extremely Low Frequency) di sekitar peralatan elektronik dengandaya≥1000W.JurnalPembelajaranFisika,6(2).https://www.academia.edu/70760681/Analisis Intensitas Medan Magnet Elf Extremely Low Frequency di Sekitar Peralatan Elektronik Dengan Daya 00W

Hidayat, M.F.A. 2020."Brushless Direct Current Aksial Tiga Fasa dengan Stator Ganda dan Rotor Internal." Universitas Jember.

Jahrudin, A., Noor, I., & Fitrian, A. (2022). Perbandingan Kuat Medan Listrik dan Medan Magnet dari SUTT di Daerah Pemukiman, Perkebunan, dan Tanah Lapang. Navigation Physics: Journal of Physics Education, 4(2).

Jahrudin, A., Noor, I., & Fitrian, A. (2022). Perbandingan kuat medan listrik dan medan magnet dari SUTT di daerah pemukiman, perkebunan, dan tanah lapang. Navigation Physics: Journal of Physics Education, 4(2). https://doi.org/10.30998/npjpe.v4i2.1544

Jumingin, J., Atina, A., Iswan, J., Haziza, N., & Ashari, B. (2022). Radiasi gelombang elektromagnetik yang ditimbulkan peralatan listrik di lingkungan Universitas PGRI Palembang. Journal Online Of Physics, 7(2), 48–53. https://doi.org/10.22437/jop.v7i2.17267

Maulana, R., & Dhofir, M. (2020). Perilaku Gelembung Udara dalam Minyak Transformator dengan Pengaruh Medan Listrik AC Non-Homogen. Jurnal Mahasiswa TEUB, 8(1).

Maulana, R., & Dhofir, M. (2020). Perilaku gelembung udara dalam minyak transformator dengan pengaruh medan listrik AC non-homogen. Jurnal MahasiswaTEUB,8(1).https://elektro.studentjournal.ub.ac.id/index.php/teub/article/view/1397

Mohamad Ramdan Febriana Herawan, Deny Hamdani, & Nanang Hariyanto. (2024). Pemodelan dan simulasi medan listrik pada jaringan distribusi 20 kV double feeder konstruksi 3B. Rekayasa Hijau: Jurnal Teknologi Ramah Lingkungan, 4(3). https://doi.org/10.26760/jrh.v4i3.109-132

Refli Maulana, & Mochammad Dhofir. (2020). Perilaku gelembung udara dalam minyak transformator dengan pengaruh medan listrik AC non-homogen. Jurnal MahasiswaTEUB,8(1).https://elektro.studentjournal.ub.ac.id/index.php/teub/article/view/1397Repository UIN Suska.2020. "Tugas Akhir Mekanisme Kerja Motor Listrik."

Rio Sandi. (2024). Analisis pengaruh kelembaban udara terhadap kuat medan listrik di sekitar saluran udara tegangan tinggi (SUTT) 150 kV quadruple. Journal of Electrical Engineering, Energy, and Information Technology (J3EIT). https://doi.org/10.26418/j3eit.v3i1.10335

Sandi, R. (2021). Analisis pengaruh kelembaban udara terhadap kuat medan listrik di sekitar saluran udara tegangan tinggi (SUTT) 150 kV quadruple. Journal of Electrical Engineering, Energy, and Information Technology (J3EIT), 3(1). https://doi.org/10.26418/j3eit.v3i1.10335

Setiyanto, R. A., Sudarti, S., & Harijanto, A. (2020). Analisis Intensitas Medan Magnet Extremely Low Frequency (ELF) di Sekitar Jaringan Distribusi PLN 20 V.FKIPeProceeding,2(1).

Setiyanto, R. A., Sudarti, S., & Harijanto, A. (2020). Analisis intensitas medan magnet Extremely Low Frequency (ELF) di sekitar jaringan distribusi PLN 20 kV.FKIPeProceeding,2(1).https://jurnal.unej.ac.id/index.php/fkipepro/article/view/6361

Susilo, Ahmat.2021 "Mengoptimalkan Fluks Magnet pada Generator AC Menggunakan Sumber Eksternal untuk Menghasilkan Tegangan." Polman Babel Repository.

Umar, A. R., & Dhofir, M. (2020). Perilaku gelembung udara di dalam minyak transformator dengan pengaruh medan listrik DC homogen.Jurnal Mahasiswa TEUB,8(1).https://elektro.studentjournal.ub.ac.id/index.php/teub/article/view/1386

Wahyuddin, A., Afriansyah, Z., Zahir Zainuddin, & Rizal A. Duyo. (2023). Analisis kuat medan listrik dan intensitas medan magnet dengan menggunakan jenis kawat terhadap nominal diameter penghantar.Journal of Muhammadiyah's ApplicationTechnology,2(3),239245.https://doi.org/10.26618/jumptech.v2i3.10467

Wahyuddin,Afriansyah,Zahir Zainuddin,Rizal A Duyo. 2023. Analisis Kuat Medan Listrik Dan Intensitas Medan Magnet Dengan Menggunakan Jenis Kawat Terhadap Nominal iameter Penghantar, Journal of Muhammadiyah's Application Technology, (3):239–245.

Khoiriyah, R.M.H,. Dan Sudarti. 2022. Resiko Paparan Medan Elektromagnetik Extremely Low Frequency (ELF) Terhadap Kelainan Otak. Jurnal Pendidikan Fisika dan Sains (JPFS). 5(2):83-87.

Suhatin, D., Sudarti, & Prihandono, T. (2017). Analisis intensitas medan magnet ELF (extremely low frequency) di sekitar peralatan elektronik dengan daya ≥ 1000 W. Jurnal Pembelajaran Fisika, 6(2), 208–214