Abdimas Umtas: Jurnal Pengabdian Kepada Masyarakat
LPPM-Universitas Muhammadiyah Tasikmalaya
Volume: 7, Issue:2, April, 2024; pp: 528-535
E-ISSN: 2614 - 8544

Testing the Electrical Safety Aspects of The Emergency Shut Down Multi Indicator (Esin) Innovation Tool for Refueling De-Refueling Trucks (RDT) at The Mutiara Palu Aircraft Filling Depot

Ratih Mar'atus Sholihah[a)], Irwan Mahmudi, Lutfiyana Andi Anshar

Electrical Engineering Study Program, Faculty of Engineering, Tadulako University, Palu, Indonesia

[a)]Corresponding author: ratih117@gmail.com

ABSTRACT

As the commercial and trading subholding of PT Pertamina (Persero), Pertamina Patra Niaga also provides aviation fuel to airlines. The aviation fuel refueling place is called the Aircraft Refueling Depot. One of the aircraft filling depots in Palu is the Mutiara Aircraft Filling Depot, located in the Mutiara Sis Al-Jufri Airport Area. The Mutiara Aircraft Refueling Depot uses a Refueling De-Refueling Truck (RDT) to fill aircraft with fuel while on the ground. This refueler unit can also pump and store fuel from aircraft. One of the problems when refueling aviation fuel by RDT at the Mutiara Aircraft Filling Depot was the activation of the emergency stop when the Certified Refueler Operator (CRO) was carrying out the service. The aviation fuel-filling system stopped without anyone realizing it, causing flight delays. The active emergency stop without a clear indicator initiates the FT Prove Pin Point group to create an Emergency Shut-Down Multi-Indicator (ESIn) tool that can monitor the active status of the emergency fuel or engine stop. Before the ESIn tool is used, one of the steps that must be carried out is a feasibility test on electrical safety aspects. Testing is carried out using three criteria, namely visual testing, component electrical parameters, and performance. Based on visual and performance testing, the tool is in good condition and can operate according to the planned purpose. Likewise, when testing component electrical parameters, the measured parameter values show values according to applicable electrical standards.

ARTICLE INFO

***Article History*:**
Submitted/Received 19 Mar 2024
First Revised 16 Apr 2024
Accepted 17 Apr 2024
First Available online 30 Apr 2024
Publication Date 30 Apr 2024

Keyword :
Refueling De-refueling Truck (RDT)
Emergency Shut-Down Multi-Indicator
safety
electrical aspects

https://doi.org/10.35568/abdimas.v7i2.4622

INTRODUCTION

Pertamina Patra Niaga, as the Commercial and trading Subholding of PT Pertamina (Persero), also provides aviation fuel for airlines and fuel oil (BBM) for cars and motorbikes. The aviation fuel refueling place is called the Aircraft Refueling Depot. Handling Avtur fuel supplies by aircraft filling depots is essential in the aviation industry. Generally, the fuel used for aviation is divided into two types, namely Avgas (Aviation Gasoline) and Avtur (Aviation Turbine). Avgas is a fuel usually used by piston-engine aircraft, while Avtur is used by aircraft with gas turbine engines (Nurma Heitasari & Daffa Al Fayyadh, 2022). Apart from providing quality aviation fuel, Pertamina also has aviation fuel service standards that refer to international standards, such as the International Air Transport Association (IATA) and the Joint Inspection Group (JIG).

One of the Aircraft Filling Depots in the city of Palu is the Mutiara Aircraft Filling Depot, which is located in the Mutiara Sis Al-Jufri Airport Area. Mutiara Aircraft Refueling Depot uses a Refueling De-refueling Truck (RDT) to fill aircraft with fuel while on the ground. This refueler unit can also pump and store fuel from aircraft. To avoid incidents and damage to the aircraft, the refueler unit is equipped with safety devices, including a braking service, Parking brake, and interlock system. The interlock system functions to ensure that the truck cannot be operated while fuel distribution is in progress. There is also an indicator panel, emergency stop, indicator light, warning device alarm, and yellow beacon light, which can rotate 360º or flash and not be blocked. Electronic discharge to ground equipment, lifting and shift transmission interlocks, and light fire extinguishers that are still fit for use, amounting to a minimum of 2 units measuring 5 kg, must also be present at the RDT. These safety tools refer to good engineering principles emphasizing oil and gas safety aspects. Oil and gas safety itself includes worker, general, installation, and environmental safety (Tim Independen Pengendalian Keselamatan Migas, 2017).

One of the problems that occurred when refueling aviation fuel by RDT at the Mutiara Aircraft Filling Depot was the activation of the Emergency Stop when the Certified Refueler Operator (CRO) was carrying out the service. When the emergency stop is active, the aviation fuel stops being distributed. This active emergency device indicates a problem and must be repaired immediately to continue the charging process. However, because the active condition of the emergency stop was not known to ground officers, the aviation fuel-filling process stopped for quite a long time. This causes delays in flights. An active emergency stop without a clear indicator initiates the FT Prove Pin Point group to create a simple technology. Technological developments have influenced all areas of life, including politics, business, culture, arts, and education (Tunnisa et al., 2024). A simple technology that helps in the aviation business in Palu is the Emergency Shut-Down Multi-Indicator (ESIn) tool. This tool can monitor the active status of emergency fuel/engine stops. There are two emergency stop indicators shown on the ESIn tool, namely emergency stop engine and emergency fuel stop.

Before the ESIn tool is used, one of the steps that must be carried out is a commissioning test on the electrical safety aspects. These tests are performed to ensure that the equipment will perform its design function safely and adequately. To be able to determine its reliability, information is needed about its function scheme and information about the reliability of each element in the scheme (Khalikov et al., 2022). This testing must also be carried out periodically to maintain the reliability and suitability of work operations and will increase the service life of the equipment (Galih Firdaus & Hidayat, 2021). One of the disturbances that may arise in electrical equipment is short circuit disturbances. The factors that usually cause electric short circuits are poor installation and the age of the conductor, which has an impact on the quality of the insulator of the conductor (Hidayat Dongka- et al., 2022). This test is very necessary because electrical installations are often used by people who do not know the basics of electrical safety issues, which is why the installation must meet high safety requirements (Eryomina et al., 2022). Therefore, the service team will carry out a commissioning test on the ESIn innovation tool. This

https://doi.org/10.35568/abdimas.v7i2.4622

commissioning test is carried out in three sequential stages, namely visual checking tests, checking component electrical parameters, and circuit performance tests. Apart from ensuring the safety of the ESIn equipment, this testing can also contribute to suggestions for improvements in electrical and electronic matters.

METHOD

Mutiara Palu Aircraft Filling Depot synergizes with universities to test the electrical safety aspects of ESIn. DPPU Mutiara, represented by the FT Prove Pin Point group, conducted consultations with the service team. Electrical testing is generally divided into three methods: Acceptance Tests (initial testing or commissioning tests), Routine Maintenance Tests, and Special Maintenance Tests (Paul Gill, 2008). For new equipment, the test is a commissioning test whose flow can be seen in Figure 1. This test ensures that the electrical equipment and systems being tested operate according to their design function and that the tested parameters are within the applicable tolerance limits. Technically, there are three stages of checking, namely:

- Visual Check
  Visual checks are carried out to ensure electrical equipment is in good condition.
- Network performance testing
  Checking the work function of the tool being made must be in accordance with the planned design.
- Checking component electrical parameters
  Checking electrical parameters uses special equipment to check and ensure that there are no errors and that the electrical parameter values are still within tolerable limits.

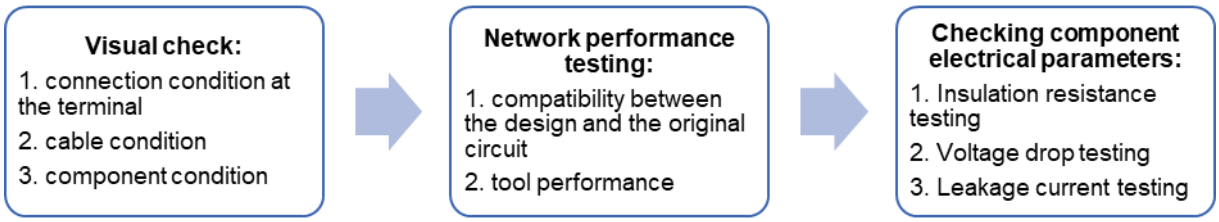

FIGURE 1. Commissioning test flow

RESULTS AND DISCUSSION

Visual Check

The initial check is carried out by physically looking at the condition of the equipment installation that has been made. Overall, the neatness of the installation is safe, but the sensor control cable needs to be tidied up again. Apart from that, during installation observations, it was discovered that the control system already uses a negative supply, so from a safety perspective, it is already in a safe condition.

Performance Check

Performance checking is carried out by activating the ESIn system and paying attention to the performance process sequentially and the general response shown on the tool. ESIn components consist of:

- 24 V DC 5-pin relay
- LED STRIP 24V DC 3 Eyes yellow and blue

https://doi.org/10.35568/abdimas.v7i2.4622

- 0.7mm cable
- 1 mm cable lug
- Burnt insulation 1 mm
- Junction Box
- 24V Alarms

Figure 2 is a picture of the ESIn installation. The working principle of ESIn is to activate the LED indicator light and buzzer if the contractor is active. The contactor is active if one or both emergency switches are active when pressed. These emergencies are emergency fuel stops and emergency engine stops, which are represented by the NC and NO push buttons for each emergency. If the emergency engine stop is pressed, the NC on the negative line will also be active so that the contactor is active. This is what is expected to happen so that there are indicators that can be seen and heard by officers to provide a quick warning of any disturbances in avtur filling.

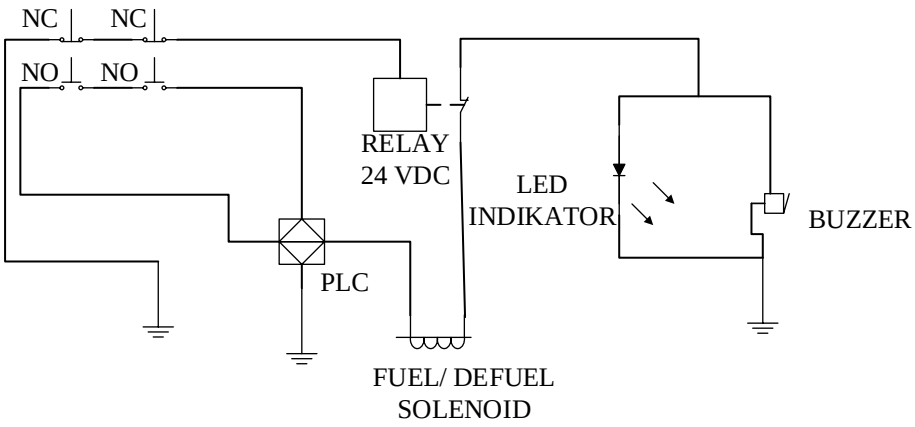

FIGURE 2. Single line diagram of the ESIn system

When checking the performance, the tool can work well in accordance with the expected sequence and purpose, as in Figure 3, which shows the emergency fuel stop LED indicator light is active. Checking work sequences and procedures can be seen in Table 1 with 2 case conditions, namely case 1: emergency engine active and case 2: emergency fuel active,

FIGURE 3. Emergency fuel stop on indicator

https://doi.org/10.35568/abdimas.v7i2.4622

TABLE 1 . ESIn tool performance

	NO fuel stops	NC fuel stop	NO engine stops	NC engine stops	Contactor	White LED	Yellow LED	Buzzers
Case 1	Off	Off	On	On	On	On	Off	On
Case 2	On	On	Off	Off	On	Off	On	On

Checking Component Electrical Parameters

Knowing the amount of insulation resistance of electrical equipment is essential to determine whether the equipment can be operated safely. There are three parameters that will be tested on the ESIn tool, including:

- Insulation resistance testing
- Voltage drop testing
- Leakage current testing

Insulation resistance of the installation cable Electricity is one of the determining elements the quality of the electrical installation, considering the main function Isolation as a means of securing electrical installations (Yusniati & Pelawi, n.d.). The isolation referred to in the first test is isolation between live parts and other live parts or non-live parts such as body/ground. To measure insulation resistance, a Mega Ohm Meter / Insulation tester is used. An insulation tester is a tool for measuring the value of insulation resistance. The principle of measuring an insulation tester is the same as an ohm meter, namely providing voltage from the measuring instrument to the equipment insulation. Because the insulation resistance value is relatively high, a reasonably high voltage is required to flow current. The measuring voltage used depends on the working voltage of the tool to be measured (Hidayat Dongka- et al., 2022).

The results of the Megger test that was carried out during the testing activity showed an OL (Over Load) value as in Figure 4. The OL value indicates that the insulation resistance of the tool being tested is outside the measurable range/extensive, so this condition is very safe.

FIGURE 4. Insulation resistance test results using a megger

The test is stress testing. Voltage testing aims to determine the magnitude of the voltage drop at the end of the circuit. This test is carried out by measuring the voltage on each block. Different parts of the voltage in a power system cause a voltage drop and are also influenced by several factors such as

https://doi.org/10.35568/abdimas.v7i2.4622

resistance, reactance, and impedance in the line. The voltage drop on the line is the difference between the voltage at the base of the shipment and the voltage at the receiving end of electricity (Hermanu & Apribowo, 2019). Measurements are also divided into two parts, namely, when conditions are without load and when conditions are with load. The voltage source used in the ESIn tool is 24-28 Vdc. During testing, the voltage at the ends of the terminals remained at 28 Vdc, as shown in Figure 5. These results show that there is no voltage drop when the system is activated.

FIGURE 5. Results of stress testing on the ESIn tool

Another component parameter test is leakage current testing. This test can also indicate the security of a device. Leakage current is a current that occurs if the conductor insulation cannot meet applicable standards, both between conductors and the earth (Olesz et al., 2023). So, the presence of this leakage current can indicate a disturbance or insecurity in the conductor. The leakage current is required to determine the longterm capability of the outdoor epoxy resin insulators (Utami et al., 2021). The leakage current limit, according to the standard, is less than 1 mA. The leakage current that occurs can be influenced by the humidity temperature of a voltage because the higher the humidity temperature, the greater the current that crosses and enters the circuit. The results of the leakage current test on the ESIn tool are shown in Figure 6.

FIGURE 6. Results of leakage current testing on the ESIn tool

https://doi.org/10.35568/abdimas.v7i2.4622

The three electrical parameter test results are summarized in Table 2 with reference to safe standards based on applicable electrical standards. The standard used is the 2011 General Electrical Installation Regulations standard. Based on the applicable standard, the working voltage must not be less than -10% (Badan Standarisasi Nasional (BSN), 2014), this can be fulfilled by the ESIn device with no voltage drop at the end of the circuit or -0% of nominal voltage. The insulation resistance measurement value that shows the OL value means the insulation resistance value is more than 1MΩ at a test voltage of 500V (Nada Fitsa Alfazumi1, 2020). including in conditions that comply with the standard. Likewise, the leakage current's value is 0.01A or far below 0.6A(Technical Committtee 64, 2016). The test results obtained measurement values that still met the standards and were even included in good values.

TABLE 2. Data on electrical parameter testing results

No	Parameter	Standard	Measurement value	Information
1	Working Voltage	-10% of nominal V	28V (-0%)	Good
2	Isolated Prisoner	More than 1MΩ	OL (Over Load)	Good
3	Leakage Current	< 0.6 A	0.01 A	Good

CONCLUSION

The Emergency Shut-Down Multi-Indicator (ESIn) is new equipment, so the test carried out is a commissioning test. This test ensures that the electrical equipment and systems being tested operate according to their design function and that the parameters tested are within the applicable tolerance limits. Technically, there are three stages of checking, namely, visual checking, circuit performance testing, and checking component electrical parameters. These three checks show the results that the ESIn tool functions according to the design, and its parameters are within the appropriate limits, so it is very safe to use on Refueling De-refueling Truck (RDT) vehicles.

REFERENCES

Badan Standarisasi Nasional (BSN). (2014). *Persyaratan Umum Instalasi Listrik 2011* (2014th ed.). Standar Nasional. Indonesia (SNI).

Eryomina, T. V., Galeguzova, I. A., Shanygin, I. A., Dasheev, D. E., & Aleksandrov, N. V. (2022). To the problem of technogenic safety of electrical installations at the objects. *AIP Conference Proceedings*, *2762*. https://doi.org/10.1063/5.0128707

Galih Firdaus, A., & Hidayat, R. (2021). Analisa Pengujian Kelayakan Operasi Pemutus Tenaga (PMT) 150 kV Bay Penghantar Mandirancan I Berdasarkan Parameter Breaker Analyzer di Gardu Induk Sunyaragi. *ELECTRICIAN – Jurnal Rekayasa Dan Teknologi Elektro*, *15*(3), 252–267.

Hermanu, C., & Apribowo, B. (2019). Study Analysis of Voltage Drop in a Typical Office Building Lighting System: A Case Study of of FEM IPB Building Electrical Installation. *Journal of Electrical, Electronic, Information, and Communication Technology (JEEICT)*, *1*(1), 26–31.

Hidayat Dongka-, R., Akmal Hidayat-, M., Elektronika, P., & Teknologi Industri Dewantara Palopo, A. (2022). Evaluasi Instalasi Listrik Gedung Perkantoran dengan Metode Standarisasi Puil 2011. *DEWANTARA. J. Tech*, *03*(02).

Technical Committtee 64. (2016). *IEC 60364-6* (2nd ed., Vol. 4).

Khalikov, S., Khalikov, S., Rahmatov, D., Atazhiyev, S., & Bakizhanov, A. (2022). Issues of Reliability and Safety of an Electrical Substation. *AIP Conference Proceedings*, *2552*. https://doi.org/10.1063/5.0117214

Nada Fitsa Alfazumi1, W. S. W. Y. (2020, December 1). Uji Kelayakan Instalasi Listrik di Universitas Bangka Belitung Berdasarkan PUIL 2011 (Studi di Gedung Fakultas Teknik). *Seminar Nasional Teknologi Informasi, Komunikasi Dan Industri (SNTIKI) 12*.

https://doi.org/10.35568/abdimas.v7i2.4622

Nurma Heitasari, D., & Daffa Al Fayyadh, M. (2022). ANALISIS UTILITAS REFUELLER DALAM OPERASI PENYALURAN DI DPPU A PT P. *SNTEM*, *2*, 1056–1063.

Olesz, M., Litzbarski, L. S., & Redlarski, G. (2023). Leakage Current Measurements of Surge Arresters. *Energies*, *16*(18). https://doi.org/10.3390/en16186480

Paul Gill. (2008). *Electrical Power Equipment Maintenance and Testing (Power Engineering) 2nd Edition*. CRC Press.

Tim Independen Pengendalian Keselamatan Migas. (2017). *ATLAS Keselamatan MIGAS* (Vol. 2). Direktorat Jenderal Minyak dan Gas Bumi.

Tunnisa, K., Rahman, R., Alvian,), Putra, T., Mar'atuttahirah,), Rosmiati,), Hakim, L., Fahrisal, J., Akmal,), Syam, B., Bacharuddin,), & Habibie, J. (2024). *Microsoft Project Application in Optimizing Activities for Compiling Activity Programs at the Lapadde Village Office*. *1*, 52–57. https://doi.org/10.35568/abdimas.v7i1.4173

Utami, A. M. S., Syakur, A., & Hermawan, H. (2021). Analysis of Leakage Current and Insulator Resistivity for Quality Assurance of Medium Voltage Network Polymer Insulators Alumina - SiO2 in Tropical Climate Simulator Room. *TEKNIK*, *42*(1), 10–19. https://doi.org/10.14710/teknik.v42i1.36152

Yusniati, Z., & Pelawi, T. (n.d.). PENGUKURAN RESISTANSI ISOLASI INSTALASI PENERANGAN BASEMENT PADA GEDUNG RUMAH SAKIT GREND MITRA MEDIKA MEDAN. In *Cetak) Buletin Utama Teknik* (Vol. 16, Issue 3).

https://doi.org/10.35568/abdimas.v7i2.4622