DESIGN OF A MODIFIED FUEL PUMP BASED ON A DC DYNAMO AS AN AIRCRAFT REFUELING TOOL IN THE HANGAR OF THE SURABAYA AVIATION POLYTECHNIC.

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ABSTRACT

The DC dynamo-based fuel pump on the refueling tool is a practical activity that has been carried out in the AMTO 147 D-010 hangar at Surabaya Aviation Polytechnic. Refueling procedures on training aircraft that have been carried out, especially on Cessna and TBM aircraft, there is one problem that must be resolved immediately, namely the ineffectiveness and inefficiency of the fuel pump tool used during refueling. Because it still uses manual or still uses human labor. The method used in making the design of the fuel pump tool on the electric refueling tool is with a fuel pump or pump as a tool during refueling activities. So it is hoped that with this the cadets can find out refueling learning and activities before the run up of the aircraft can easily find out the amount of fuel the aircraft needs. The result of the design of the fuel pump tool on electric refueling by using a fuel pump tool is that cadets can carry out refueling activities for Cessna and TBM aircraft easily and can speed up the refueling needed and cadets avoid other human errors.

Keywords: fuel pump, DC dynamo, refueling, Cessna aircraft and TBM

1. INTRODUCTION

Aircraft is a means of transportation that is much needed by today's society, with aircraft transportation people do not need a long time to reach the place to be visited. Therefore, many planes pass through the air every day. The increasing number of aircraft also causes the need for fuel to increase. Aircraft also require fuel as fuel for aircraft engines. And there is an airplane for cadet learning which is located in the Surabaya aviation polytechnic and is used as a practice tool for cadets before later working on airlines.

With the increasing use of fuel, of course, it requires tools when filling fuel more efficiently in order to facilitate cadets in refueling. Therefore, the fuel pump is very influential in carrying out the learning practice of the cadets, so that the cadets can carry out the practice easily and quickly in filling fuel before the run-up of the aircraft. the fuel pump in the Surabaya aviation polytechnic campus is available but still uses hand rotation and makes the cadets longer when refueling and takes up a lot of time.

Tools for filling fuel of course we have found a lot by using tools that have been developed and have been accurate in their calculations. The fuel filling tool can be divided into 2 places, namely in a fuel transport truck vehicle that can deliver fuel to the aircraft directly which we often encounter while at the airport, there are also those who still use drums that are often used by cadets when carrying out practices in the Surabaya aviation polytechnic hangar and still use manual tools, of course, the fuel volume calculation is still not accurate. One of the reasons why it still uses manual tools is due to limited costs in purchasing tools that have been developed. Therefore, the author makes a "DYNAMO DC-BASED FUEL PUMP MODIFICATION DESIGN AS AIRCRAFT REFUELING TOOLS IN THE HANGAR OF THE AVIATION POLITEKNIC SURABAYA".

2. METHODS

This chapter will discuss observation data which includes the time and place of research,

2.1 Fuel

Fuel is the main fuel on the aircraft, fuel is in one tank and oxidizer in another tank. Fuel is pumped to the combustion chamber and mixed in the combustion chamber where the fuel is burned (combustion chamber). (Module 15 Gas Turbine Engine Vol 1). Fuel is divided into 2 namely:

A. Avgas

Avgas (Aviation Gasoline) is an aircraft fuel specifically for high octane aircraft. Avgas is produced from a small fraction of petroleum and is a mixture of kerosene with liquid hydrocarbons in the range of 32-220 °C. From kerosene, a refining process is carried out so that fuel for aircraft is formed. In addition, this fuel has a freezing point temperature between -100 ° C or lower than Jet A and Jet A-1 type avgas. Avgas is created for internal combustion engines.

B. Avtur

Avtur (Aviation Turbine) is a fuel that is often used for propulsion or propeller type jet aircraft. This fuel comes from the fraction of petroleum that has been taken from the earth will go through processing in such a way that it can become a fuel for transportation. This fuel has good quality, high boiling point, and has carbon bonds from C6-C12. The quality of avtur fuel is high and this is proven by the octane number which is 100. Avtur has excellent combustion characteristics with high energy content. Avtur (Jet A-1) also has a very low freezing point (below -47°C) so when used in flights with an altitude of 30,000-40,000 feet. Avtur will not freeze and can be safely supplied from the tank to the aircraft engine. avtur is specifically created for turbine or external combustion engine types.

2.2. Cessna Procedure

Each wing has an integral fuel tank, located between the front and rear spars, extending from WS 31.38 to WS 65.125. The fuel chambers should be filled immediately after each flight to reduce condensation in the tanks and lines. A fuel filler cap is located above each wing and provides a fueling/defueling point for each fuel chamber. (Cessna Model 172 Maintenance Manual Chapter 12 Servicing)

A. Refueling procedure.
ATTENTION: Ensure that the grade and type of fuel used correctly serves the aircraft. Refer to the pilot's operating handbook and the FAA approved aircraft flight manual for a list of approved fuels.

1. Aircraft and land vehicles as referred to above.
2. Ensure that the battery switch is turned off.
3. Place a protective mat around the fuel filling area and remove the fuel filler cap.
4. Aircraft fuel. Ensure that the correct grade of aviation fuel is used.
5. Remove excess fuel filler cap from wing area.
6. Remove grounding equipment.

B. Defueling Procedure

1. Make sure the battery switch is turned off
2. Remove the fuel filler cap.
3. Insert the fuel fill nozzle into the fuel tank and start filling the fuel.
4. Discharge as much fuel as possible with the defueling nozzle.
5. Drain the fuel from the drain located at the bottom of the fuselage.
6. Remove the drain valve from the bottom of the fuel tank and drain the remaining fuel.
7. Disconnect the grounding equipment.

2.4 TBM Procedure

Aviation fuel is restricted to use for more than 150 hours between overhauls, enter this time in the engine log book. Fuel used must contain anti-ice additives, as per MIL-I-27686E specification. The concentration of ethylene glycol monomethyl ether additive shall not be less than 0.06 % by volume, nor exceed 0.15 % by volume. The total capacity of R.H. or L.H. tanks is 145.3 US gal (550 liters). (Maintenance Manual TBM 700 Model Chapter 12 Servicing)

WARNING:

1. Perform fuel filling in an area free from fire.
2. Aircraft electrical circuit must be turned off.
3. Aircraft electricity must not be operated.
4. High frequency equipment operating in the vicinity of the aircraft during refueling is dangerous.
5. During thunderous weather, do not refuel.

CAUTION: ensure the correct grade and type of fuel is used to service the aircraft, see 12-11-00.

1. ensure the "source" selector is turned off.
2. place a sign prohibiting "source" selector operation.
3. connect the ground cable to the aircraft ground terminal.
4. open the filler cap with the key and remove it.

5. connect the tanker ground cable connected to the ground terminal.

6. connect the tanker/aircraft connection cable.

7. connect the clip fuel nozzle, ground cable, to the lug, attached to the filler port.

8. Insert the fuel nozzle and if necessary, the anti-ice additive nozzle into the filler port and fill with fuel.

9. Remove the fuel nozzle and if necessary, the anti ice additive nozzle.

10. Install the filler cup and lock it using the key.

11. Disconnect the ground cable.

12. Remove the operation selector "source" prohibition mark.

13. Set the "source" selector to "BAT".

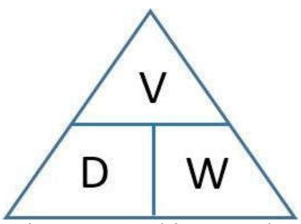
14. Check the fuel quantity display on the gage indicator.

15. Set the "source" selector to "off".

2.4 Data Analysis Technique

The data generated from further testing will be analyzed so that it can be known that the fuel pump tool is successful if the tool can be used exactly as intended, the fuel pump tool can facilitate effective practical learning, and safety when refueling on Cessna and TBM aircraft to minimize unwanted risks.

The fuel pump tool is declared unsuccessful or needs improvement if the tool cannot be used in accordance with the design and success or failure of the electric fuel pump tool from the manual fuel pump. Testing was carried out at the hangar of the lighting polytechnic by testing the fuel pump tool on the comparison of tools and using the debit formula and tube volume formula.

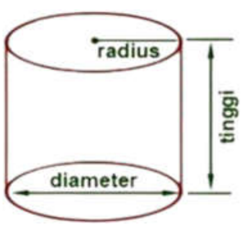


D = Debit (ℓ/s / dm^3/s)

V = Volume (ℓ/dm^3)

t = Second (s)

Figure 2.1 Debit Formula



V = volume of the tube (cm3)

R = radius of the base of the tube (cm) / (π = 22/7 or 3.14)

t = tube height (cm)

Figure 2.2 Tube

1. Volume of Tube

V = base area x height

V = π x r^2x t

2. Surface Area of Tube

Surface area of the tube = Base area + Cap area + Blanket area of the tube

Base area = π x r^2

Cover area = π x r^2

Area covered by the tube = 2 x π x r x t

L = 2π . r (r+t)

3. Perimeter of the Base or Cap of the Tube

K = 2πr

2.5 Testing Techniques

The manufacture of this tool serves for the learning process and practice of cadets in the Surabaya Aviation Polytechnic hangar when refueling on Cessna and TBM aircraft, testing techniques for this refueling tool by testing directly by distinguishing the speed of filling time from electric fuel pumps with manual fuel pumps.

3. RESULTS AND DISCUSSION

Based on the explanation of the previous research methodology, the author will present the Refueling test results that have been obtained.

3.1 Simulation Results

After testing and calculating, the results obtained are as follows:

1. The results of the design of the fuel pump tool that has been made and has been tested using a measuring instrument in the form of 1 gallon of mineral water totaling (19 ℓ) with time (t) (39 s) then for the results of

the calculation of the discharge (D) on the measuring instrument is as follows.

Located at

Volume: 19 ℓ

t : 39 s

Asked: Discharge (ℓ/s or dm3/s)

Answer

D : v/w

D : 19/39

D : 0.487 ℓ/s

2. The result of the discharge obtained from the above calculation is 0.487 (ℓ / s). the result of the discharge is found then after that find how much time is needed in filling the Cessna 172 aircraft can be fully charged?

3. Cessna 172 aircraft requires 53.0 Gallons of fuel (53.0 × 3.785 = 200.605ℓ) Maintenance Manual Cessna Model 172 Chapter 12 Servicing

Known

Volume: 19 ℓ

D: 0.487 ℓ/s

Asked: Time (s)

Answer

D : v/t

t : v/Q

t : 19/0,487

t : 39 s

4. If the Cessna 172 aircraft requires full fuel, how many gallons of aqua are needed?

$$\frac{\text{full tank pesawat cessna 172}}{\text{1 galon aqua}} = \frac{200.605}{19} = 10{,}56 \text{ liter galon}$$

aqua

Cessna 172 aircraft in full state requires 10.56 gallons of aqua and takes how long to fully charge?

10.56 x 39 = 412 seconds / 6 minutes 52 seconds

So the Cessna 172 airplane tank in full state takes 6 minutes 52 seconds and requires 200.605 ℓ of fuel.

3.2 Tool Design Comparison

By taking examples of existing products to compare with other fuel pump products and get a product innovation so as to make added value compared to existing products. As in terms of design, and faster filling time compared to existing products. For other products when charging longer and for tools made by the researcher can be faster. From the test results it can be concluded that the refueling electric tool has advantages over existing products. For the use of fuel pumps can be used when practicing refiuling and can be used on aircraft that are refueling to carry out flights or run-ups.Table 3.1 Hasil uji konduktivitas

Table 3. 1 Tool Comparison

No	Keterangan	Fuel Pump Elecric	Fuel Pump Manual
1	Putaran	47	72
2	Waktu	41 detik	1 menit 36 detik
3	hasil	20 liter	20 liter

In table 3. 1 describes the comparison of electric fuel pump tools and manual fuel pump tools. The electric fuel pump has 47 gear rotations, takes a fast time of 41 seconds, and gets the result of filling which is 20 liters. For manual fuel pump 72 turns of the hand, takes 1 minute 36 seconds, and gets the result of filling that is 20 liters.

4. CONCLUSIONS

In the tests carried out, we can draw the following conclusions:

1. Designing this fuel pump tool, we can apply the refueling practice activities in the Hangar of Surabaya Aviation Polytechnic.
2. With this fuel pump tool, we can compare how the manual fuel pump and elecric fuel pump work in the Hangar of Surabaya Aviation Polytechnic.
3. With the addition of a power supply / fuel charging battery, it can now add practical tools in the Surabaya Aviation Polytechnic Hangar. especially the practice of refueling as a result, it becomes more practical.
4. From the test results and the battery power obtained, it is because the battery that is being used is not used according to the size of the dynamo that uses 24 volts.

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