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Air Induction System Check on Toyota Soluna Engineer Stand

Bintha Ustafiano[1], Supriadi[2], Fajar Maulana[3]

[1,2,3]Automotive Technology Vocational Education, Lancang Kuning University, Indonesia
Yos Sudarso Street, KM 8 Rumbai, Pekanbaru, Riau, Indonesia

Corresponding author: binthaastafiano@unilak.ac.id

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ABSTRACT

The purpose of this study is to examine the Air Induction System on the Toyota Soluna 5A-FE Engine Stand. The research method used an experimental method and was carried out for two months from July 2020 to August 2020 at the Padang State University Workshop.How to check the components of the Toyota Soluna 5A-FE engine stand air induction system is divided into three ways, namely, voltage check, resistance check, and visual inspection. The purpose of examining the air induction system on the Toyota Soluna 5a-fe engine stand is to repair the Toyota Soluna engine stand in the FT UNP automotive workshop so that it can be reused as material for the teaching and learning process in the FT UNP automotive workshop. The Toyota Soluna 5a-fe engine stand in the FT UNP automotive workshop is in a dead engine condition, the wiring system is messy and some parts of the stand are porous. Therefore, the author will examine the air induction system on the Toyota Soluna 5a-fe engine stand. The inspection process for the Toyota Soluna 5a-fe engine stand air induction system consists of: the process of dismantling the components of the air induction system, the process of checking the components of the air induction system, the process of repairing the wiring system, the process of installing components after the inspection process is complete, the testing process is carried out and the Toyota Soluna engine stand can live normally so that it can be reused as teaching material in the FT UNP automotive workshop.

Keywords: Inspection, Engine Stand, Air induction System

INTRODUCTION

The more science and technology develops, the more new innovations are developed in the industrial world, especially the automotive industry. An example is innovation in car technology, at first the car used a carburetor as a place to mix fuel and air. in the carburetor system the amount of fuel and air mixture that enters the combustion chamber is measured based on the suction from the piston movement in the cylinder block, this movement is done mechanically making it difficult to get the ideal fuel and air mixture [1]. This causes the carburetor system to tend to be more wasteful and produce exhaust emissions. To overcome this, at this time an electronically controlled system or better known as EFI (electronic fuel injection) was developed [2].

In the EFI system, the mixing of fuel and air is regulated by the electronic control unit (ECU), the ECU in a car has the same function as the human brain. EFI or electronic fuel injection consists of three systems namely, electronic control system, fuel system and air induction system. Of the three systems, the air induction system has an important function, namely to distribute clean air into the combustion chamber or cylinder [3]. If the air induction system does not work properly, it is certain that the combustion process of the fuel and air mixture will not be carried out perfectly.

The process is checking air induction system with maintenance. Maintenance is an activity that is carried out repeatedly with the aim that the equipment remains in the same condition as it was originally [4]. Maintenance is also carried out to keep the equipment in a condition acceptable to its users. All activities or actions taken to maintain the condition of a facility back to optimal operational conditions so that its service life can be extended [5].

The maintenance of inspection is a systematic process to objectively obtain and evaluate evidence regarding statements about events, with the aim of determining the level of conformity between statements with established standards and conveying the results to interested users [6]. Inspection is part of maintenance that is classified as preventive maintenance which is carried out at certain intervals with the aim of eliminating the possibility of interruptions, traffic jams or machine damage.

Preventive maintenance is maintenance that is carried out at certain intervals and its implementation is carried out routinely with several instruments that were carried out previously [7]. The goal is to prevent and reduce the possibility of a component not meeting normal conditions. The work performed in preventive maintenance is checking, viewing, adjusting, calibrating, lubricating, and other work that is not the replacement of heavy spare parts. Preventive maintenance helps the equipment to work properly according to what is stipulated by the manufacturer [8][9].

However, preventive maintenance to machines with conventional carburetors, the amount of fuel required by the engine is regulated by the carburetor. In modern engines using the EFI system, the amount of fuel is regulated (controlled) more accurately by the computer by sending the fuel to the cylinder through the injectors [10][11]. The EFI system determines the optimal (correct) amount of fuel according to the amount and temperature of the incoming air, engine speed, cooling water temperature, throttle valve position, and other important conditions [12][13].

One of the EFI machines in the Padang State University Automotive Workshop is the Toyota Soluna 5A-FE Engine stand. The Toyota Soluna 5A-FE engine stand is in a dead engine condition and the frame of the engine stand is shaky (porous), besides that the cables on the engine stand are very messy. As a result of these problems the Toyota Soluna 5A-FE engine stand cannot be used as a practicum tool by Automotive Engineering students at the Faculty of Engineering, Padang State University.

Because of these problems, the purpose of this study is to examine the Air Induction System on the Toyota Soluna 5A-FE Engine Stand. The hope of this final project is that the Toyota Soluna 5A-FE engine stand can function optimally again, so that the teaching and learning process for students of the Department of Automotive Engineering, Faculty of Engineering, Padang State University can run as before.

RESEARCH METHOD

The research method used an experimental method and was carried out for two months from July 2020 to August 2020 at the Padang State University Workshop. Examination Procedure sensors in the air induction system on the Toyota Soluna 5a-fe engine stand, idle speed control valve, throttle body, intake manifold and intake air chamber [14]. Data collection and instruments using observation and observation sheets to determine the quality of the Air Induction System on the Toyota Soluna 5A-FE Engine Stand. Data analysis uses a quantitative approach.

RESULT AND DISCUSSION

Checking the Sensors in the Air Induction System

Checking the throttle position sensor is done by checking the voltage at the throttle position sensor terminal as shown in the following table:

Table 1. Throttle position sensor voltage standards

Terminal	Condition		STD Voltage
IDL-E2	IGS W	Throttle valve open	9-14V
VC-E2		-	4.5-5.5V

VTA-E2	O N	Throttle valve fully closed	0.3-0.8V
		Throttle valve fully open	3.2-4.9V

(Source: [15])

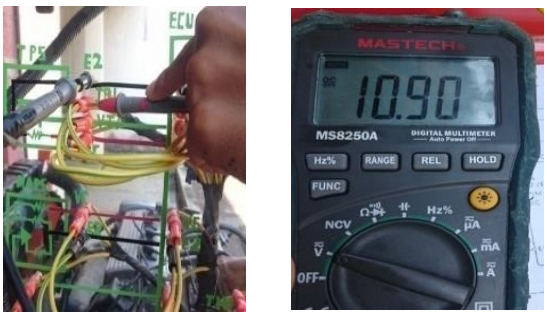

Figure 1. IDL-E2 throttle position sensor voltage check

Examination Results: the voltage at the IDL-E2 terminal is 10.90 V. It can be concluded that the condition of the throttle position sensor circuit is still in good condition and suitable for use, because it has not exceeded the standard values contained in table 2.

Figure 2. TPS voltage check at terminal VC-E2

Examination results: the voltage at the VC-E2 terminal is 4.9 V. It can be concluded that the VC-E2 terminal circuit is still good because it is not more or less than the standard contained in table 3.

Figure 3. VTA-E2 voltage check when throttle valve is fully closed

Examination Results: the voltage at the VTA-E2 terminal when the throttle valve is fully closed is 0.583 V. It can be concluded that the throttle position sensor terminal voltage circuit on VTA-E2 when the throttle valve is fully closed is still in good condition and not more or less than the standard value contained in table 4.

Figure 4. VTA-E2 terminal voltage check when the throttle valve is fully open

Examination results: the voltage at the VTA-E2 terminal when the throttle valve is fully open is 3.85 V. It can be concluded that the condition of the throttle position sensor circuit voltage is in good condition [16][17], nothing is more or less than the standard voltage contained in table 1.

1. Check Engine Cooling Temperature Sensor

Checking the engine coolant temperature sensor is carried out by measuring the sensor

voltage when the engine temperature reaches 800 C, as shown in the following table:

Table 2. Engine coolant temperature sensor voltage check standards

Terminal	Condition	STD Voltage
THW-E2	IG SW ON	0.2-1.5V

(Source: [15])

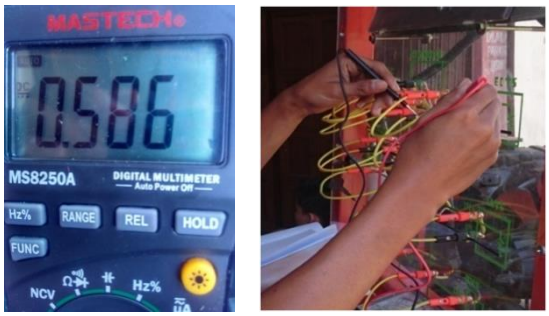

Figure 5. Checking the THW-E2 voltage on the engine coolant temperature sensor

Examination results: the voltage at the THW-E2 terminal on the engine coolant temperature sensor is 0.582 V and it can be concluded that the sensor circuit is in good condition because it has not exceeded or is less than the standard voltage contained in table 2.

2. Check Manifold Absolute Pressure Sensor

Checking the Manifold absolute pressure sensor circuit is carried out by checking the voltage at the sensor terminal, namely between the PIM-E2 and VC-E2 terminals.

Table 3. Absolute pressure sensor manifold voltage standards

Terminal	Condition	STD Voltage
PIM-E2	IG SW ON	3.3-3.9V
VC-E2		4.5-5.5V

Figure 6. Checking the PIM-E2 terminal voltage

Examination results: the voltage that exists between the PIM-E2 terminals is 3.85 V. From these results it can be concluded that the voltage in the absolute pressure sensor manifold circuit is normal and has not exceeded the standard voltage contained in table 3.

Examination results: the voltage that exists between the VC-E2 terminals is 4.9 V. From these results it can be concluded that the voltage circuit between the VC-E2 terminals on the absolute pressure sensor manifold is still in a normal state and has not exceeded the standard voltage contained in table 3.

3. Intake Air Temperature Sensor (IATS) Circuit Check

Inspection of the intake air temperature sensor circuit is carried out by checking the voltage at the sensor terminal to determine [18][19] whether the intake air temperature sensor is in good or bad condition as shown in the following table.

Table 4. Intake air temperature sensor voltage standards

Terminal	Condition	Voltage
THA-E2	IG SW ON	0.5-3.4V

(Source: [14])

Figure 7. Checking the intake air temperature sensor voltage

Examination results: the voltage between the THA-E2 Terminals is 1,774 V. It can be concluded that the intake air temperature sensor circuit is in good condition and has not exceeded the standard values contained in table 4.

Check Idle Speed Control Valve

Checking the idle speed control valve is carried out by measuring the resistance between terminal B+ and other terminals (RSO and RSC) and checking whether the idle valve can open and close [20][21]. Check idle speed control valve resistance:

1. Disconnect the idle speed control valve connector
2. Using an ohm meter, measure the resistance between B+ and the RSO and RSC terminals.
3. Replace the idle speed control valve connector

Table 5. Prisoner standardsidle speed control valve

Terminal	Standard Resistance
B+ - RSC	At 20°C = 16.5 – 21.5 Ω
B+ - RSO	At 20°C =16.5 - 21.5 Ω

(Source: [14])

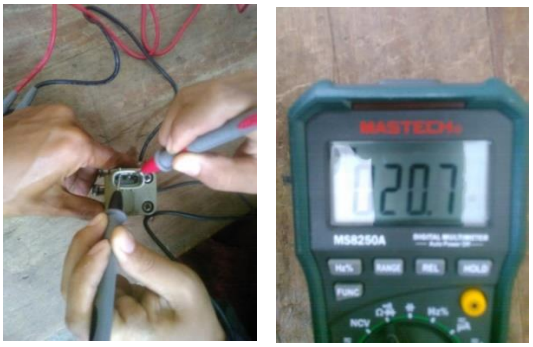

Figure 8. Resistance check at terminal B+ - RSC

Examination results: from the results of the inspection, the resistance between terminal B+ - RSC is 20.7 ohms, this value is still at the standard resistance contained in table 4, so it can be concluded that the resistance B + - RSC is in good condition or in standard conditions.

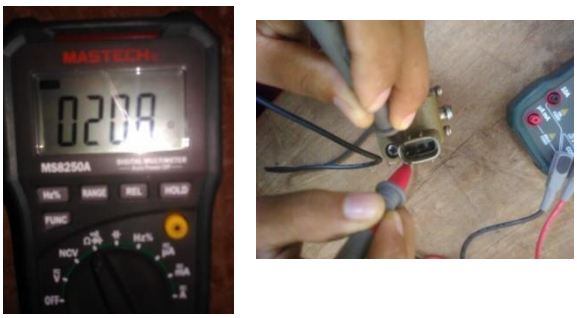

Figure 9. Resistance check at terminal B+ - RSO

Examination results: from the inspection results, the resistance between terminals B+ - RSO is 20.8 ohms, this value is still at the standard resistance contained in table 4, so it

can be concluded that the resistance B + - RSO is in good condition or in standard conditions [22].

Idle Speed Control Valve work check:

1. Remove the throttle body from the engine stand.
2. Remove the idle speed control valve from its seat.
3. Connect the positive (+) battery lead to the +B terminal and the battery negative (-) lead to the RSC terminal, ensuring that the valve is closed.
4. Connect the positive (+) battery lead to the +B terminal and the negative (-) battery lead to the RSO terminal, ensuring that the valve is open.
5. Replace the idle speed control valve in its holder
6. Reinstall the throttle body on the engine stand.

Inspection results: From the results of the inspection between the positive (+) battery cable to the +B terminal and the negative (-) battery cable to the RSC terminal the idle speed control valve is closed [23]. So it can be concluded that the idle speed control valve is working in good condition.

Inspection results: between the positive (+) battery cable to the +B terminal and the negative (-) battery cable to the RSO terminal the idle speed control valve is open. So it can be concluded that the idle speed control valve is working in good condition.

Throttle Body Check

Clean the throttle body:

1. Remove the throttle body
2. Using a soft brush or brush with carburetor cleaner clean the throttle space.

Figure 10. Cleaning the throttle body using a brush

Figure 11. Cleaning the throttle body using a carburetor cleaner

3. Using

A compressor, clean all channels and openings. Check throttle body:

1. Check that there is no gap between the throttle stop screw and the throttle lever when the throttle valve is fully closed.
2. There is no specification gap when the throttle valve is fully closed.

Examination results: From the inspection results there is a slight gap, the thing that is done is the process of tightening the throttle stop screw. After tightening the throttle valve is

in a fully closed condition. It can be concluded that the throttle valve is in good condition [24].

Inspection of Intake Manifold and Intake Air Chamber

Inspection of the intake manifold and intake chamber is carried out visually only, namely by checking whether there are cracks in the parts of the connecting pipes with the compression chamber and the connections between one pipe and another. Examination results: from the results of a visual inspection there were no cracks in the intake manifold and intake air chamber parts [25]. So that it can be ensured that the intake manifold and intake air chamber are in good condition.

CONCLUSION

1. Maintenance the components of the air induction system engine stand toyota soluna 5A-FE is by cleaning or replacing components when they are no longer standard, checking sensor circuits related to air induction systems such as manifold absolute pressure sensors, intake air temperature sensors, and sensors throttle position.
2. Check the components of the Toyota Soluna 5A-FE engine stand air induction system is divided into three ways, namely, voltage check, resistance check, and visual inspection.
3. The way to identify damage to the components of the Toyota Soluna 5A-FE engine stand air induction system is by comparing the voltage, resistance, and condition of the device with the standard Toyota Soluna 5A-FE engine stand manual.

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