Jurnal MEDIATEK, 2 (1) (2023) 7-11
ISSN : 2962-4185
AKADEMI TEKNOLOGI BOGOR

Repair and Maintenance of Power Window System on Mazda MR90

Dadang Rustandi [1*], Hamid Nasrullah [2]
D3 Mechanical Engineering Study Program, Akademi Teknologi Bogor
Jl. Bina Marga No.17, RT.05/RW.08, Baranangsiang, Kec. Bogor Tim., Kota Bogor, Jawa Barat 16143, Indonesia

ABSTRACT

In the progress of the current era, cars are a means of transportation that is needed to support the need for transportation facilities, and various other human needs. So many car companies pay attention to all aspects in the design of the car vehicle to be made, the aspect that is considered in addition to the effectiveness of the car itself is also very concerned about the aspects of comfort and safety in creating its own car design, one of which is by making changes to the design of the glass cover called Power Window which originally used a manual rotary crank for the process of closing the car glass. The purpose of this final project is to find out the application of the Power Window system on the 1990 Mazda MR car. The final result in this study, the Madza MR 1990 car, which originally used a rotary crank to move the car door glass, became a Power Windows system where to move the car door glass using an electronic system, namely by pressing the switch.
***Keywords**: Power Window System, Mazda MR90 Car.*

Corresponding author: dadangrust@yahoo.com
History of Article: Received: Jan 2023. Revision: Apr 2023. Published: Jul 2023.

Introduction

The development of technology today is very influential in various fields. We can find this in current model vehicles which are easier to operate, for example for the comfort aspect. Cars now are not only engines whose technology is very sophisticated, but there have been additions or equipped with body electrics. The circuit of this electrical body consists of an electric motor as the driving force, when a current is applied, this motor will work according to its function. Electrical examples of this body are in the Power Window system, power door lock, mirror (mirror), washer and wiper, sun roof and so on.

At the beginning of the emergence of electric circuit car vehicles, only found in the lighting system, did not know what Power Window was, at first opening and closing the car window still used manual technology, namely by turning the lever on the door to push the regulator lever so that the car glass went up and down, of course it was very inefficient and uncomfortable, With the development of technology, a Power Window system has been developed that makes it very easy for drivers, namely vehicle users only press the button on the door so as to provide electric current to the Power Window series so as to move the Power Window motor which functions to raise and lower the car glass.

In the manual crank working system, the user must rotate the glass crank on the car door, in order to be able to adjust the height of the glass desired by the user, so that it can reduce comfort and effectiveness when driving, in the use of the manual crank system on Mazda mr car vehicles in 1990 can even result in accidents that we don't want, because the driver's concentration is reduced when one

of his hands turns the crank, which at least takes relatively little time and the hope is that the development of this Power Window system can create safety and comfort for car users.

Based on the above background, the main problems can be arranged so that in this Final Project they do not deviate far from the problems raised. So in this case, the author provides the following main problems:

1) Can't go up/down on the power window,
2) There is damage that occurs in the Power Window system.
3) It has not been done correctly.

Research Objectives

1) To find out how the Power Window system works.
2) For how to fix the Power Window system.
3) For how to find out the maintenance that occurs in the Power Window system.

Theoretical Foundations

Definition of Power Window System

According to Buntarto (2015:47), the Power Window system is an electrical circuit of the vehicle body that functions to open and close the door glass using a switch, where the Power Window switch is attached to the inside of the door. When the Power Window switch is pressed, it will rotate the Power Window motor and this rotational motion will be changed by the regulator to an up and down motion to close or open the door glass.

The safety and comfort of a car is one of the things that must be achieved by car manufacturers so that their production can be well received by consumers. One of the conveniences in a car is the application of the Power Window system where the car door glass can be moved up and down according to the user's taste just by pressing the drive switch from the Power Window itself. The movement of the car glass up and down is caused by the rotation of the DC motor that has been applied to the glass drive regulator. The rotation of the DC motor is transmitted to the regulator then the regulator converts the rotational motion of the DC motor into a translational motion up and down the car window.

Power Window Components

According to Mustarom and Raharjo (2010:720), a window driver is an electronic device installed on a vehicle to help raise and lower the car window. Components needed for the manufacture of a Power Window system include:

1) Saklar Power Window
2) Glass regulator
3) Motor Power Window
4) Relay Power Window
5) Sekring/fuse
6) Connecting cable
7) Accu/battery
8) Ignition

Working Principle of Power Window

The Power Window system is an assembly of an electrical body that functions to open and close windows using a switch, the Power Window motor rotates when the Power Window switch is pressed. The rotation of the Power Window will change up and down through the window regulator to open or close the window. The type of motor used in the Power Window system is a DC motor.

Electric motors use electrical energy and magnetic energy to generate mechanical energy, the operation of the motor depends on the interaction of two magnetic fields. In simple terms, it is said that electric motors work on the principle that two magnetic fields can be made to interact to produce motion. The purpose of the motor is to generate a driving force.

How Power Window works up

When the switch is pulled up, at the same time the electric current from the battery will be flowed to the fuse/fuse and then go to the ignition > circuit breaker > up terminal > switch > drive motor > E switch terminal > mass. At the same time, the Power Window motor will rotate clockwise, then move the cable mechanism or regulator then the glass will move upwards.

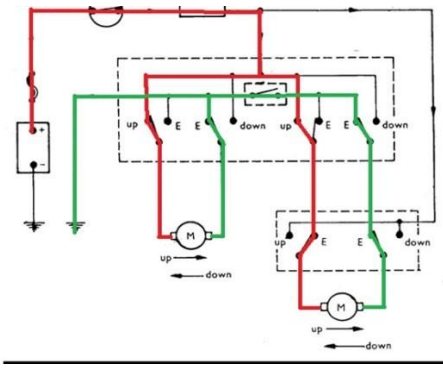


Figure 2.11 How Power Window goes up

How Power Window drops

When the switch is pressed down, then at the same time the electric motor will rotate counterclockwise through the phase > the ignition key > circuit breaker > the down terminal > the switch > the drive motor > thermal E > mass. At this time, the Power Window motor will rotate counterclockwise and then be passed on by a cable mechanism or regulator that makes the glass go down.

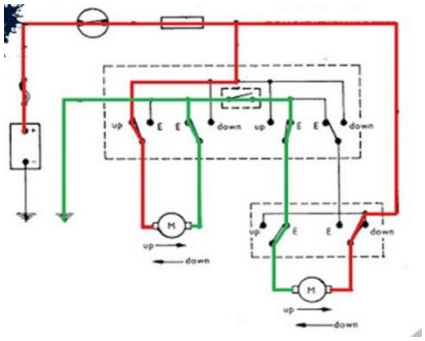


Figure 2.12 How Power Window drops work

Research Methodology

Power Window and replacing the manual crank are found in the Power Window system of the Mazda MR90 car door. This research uses a qualitative method by conducting direct observation and practice in the automotive lab of the Bogor Academy of Technology.

Tools and Materials

Power Window system props require tools and materials. Here are the tools and materials needed for the inspection and repair of the Power Window system on the Mazda MR90 car. Here are the tools for checking and repairing the Power Window system.

1) 1 Ring and Fit Combination Lock Unit
2) Screwdriver plus
3) 1 Socket lock set
4) Pliers
5) Connecting cable
6) 1 WD40 Bottle
7) 1 Botol Grease
8) Accu/Battery
9) Nuts and Bolts

Initial Conditions of the Regulator

In the results of the inspection, there were damage results where the right and left front Power Window parts were damaged, namely the Power Window regulator could not go up/down.

Inspection Process

The examination analysis uses 2 methods at once, namely the observation method and the consultation method. This check has 4 Power Windows on the Mazda MR90 car where the author can find out whether the Power Window has a problem or not.

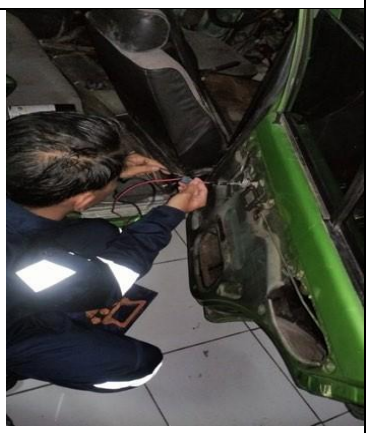
Result and Discussion

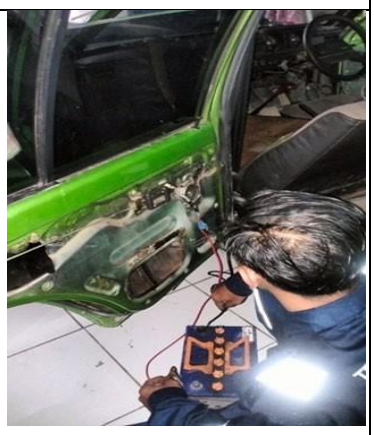
The problem with the Power Window, because there is rust on the metals of the Power Window regulator. The rust that forms occurs due to water entering through the rubber (seal) of the door. Power Window up/down congestion also occurs due to the lack or dryness of lubrication in the Power Window regulator, the regulator will become stiff so that the glass cannot go up or down even though the Power Window drive motor is rotating.

Initial Checking Process

To find out the problems with the power window, the initial check is carried out as follows:

Table 4.1. Initial check

1.	Front right power window	The test without a switch is by directly applying current to the *Power Window* motor by connecting 2 wires contained in the *Power Window motor* to the current source, namely the battery back and forth where 1 wire to the positive (+) battery and 1 more wire to the negative (-) battery.	 **Figure 3.11 Checking Power Window on the front right**
2.	Power window on the right rear	Testing without a switch is by directly applying current to the *Power Window* motor by connecting the 2 wires contained in the *Power Window motor* to the current source, namely the battery alternately – reverse where 1 wire to the positive (+) battery and 1 more wire to the negative (-) battery	 **Figure 3.13 Checking the Power Window Right back**
3	Front left power window	The test without a switch is by directly applying current to the *Power Window* motor by connecting 2 wires contained in the *Power Window motor* to the current source, namely the battery back and forth where 1 wire to the positive (+) battery and 1 more wire to the negative (-) battery.	 **Figure 3.15. Checking the Front Left Power Window**

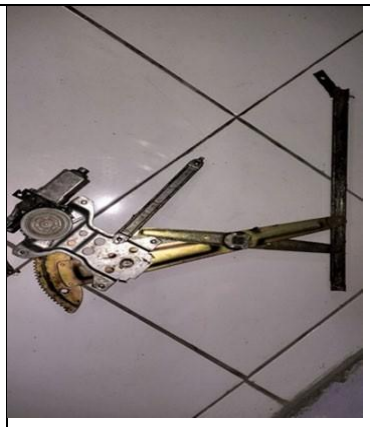
4	Power window on the left rear	The test without a switch is by directly applying current to the *Power Window* motor by connecting 2 wires contained in the *Power Window motor* to the current source, namely the battery back and forth where 1 wire to the positive (+) battery and 1 more wire to the negative (-) battery.	 **Figure 3.17 Checking *Rear left* Power Window**

Repair Process

In this repair process are the steps to check and repair all components on the Mazda MR90 Power Window system. The results of the repairs made to the x-arm regulator can be seen in the table below.

Table 4.2. Regulator Repair

No	Component Name	Process	Documentation
1.	Right front door regulator	After being analyzed, the problem that occurred was in the x-arm regulator that was dragging/jammed. Repairwith WD40 spraying and Grease smearing on the engsel regulator.	 **Figure 4.1 After the Right Part**

2.	Left front door regulator	After being analyzed, the problem that occurred was in the x-arm regulator that was dragging/jammed. Repairs by spraying WD40 and applying Grease on the regulator hinges.	 **Figure 4.2 After fixing the left part**

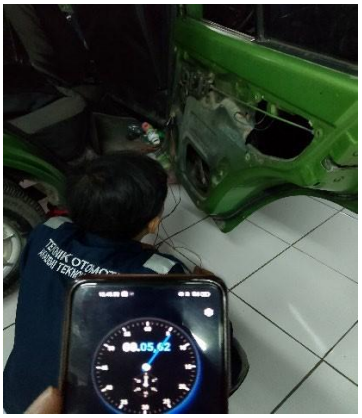
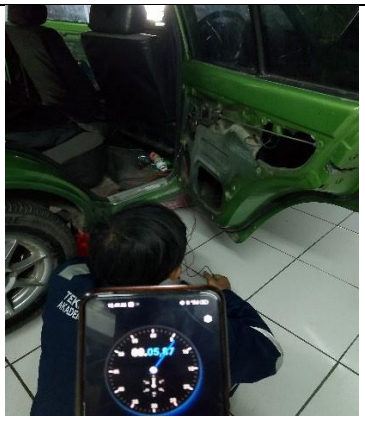
In this repair process are the steps to check and repair all components on the Mazda MR90 Power Window system which will be the determinant of the test results and will be recorded with some of these discussions.

Test Results

The test results on the Power Window system of the Mazda MR 90 car can be seen in the table below.

Table 4.3. Test Results

No	Component Name	Testing Process	Documentation
1.	Right front power window regulator.	Test results on power regulators Window i.e. direct testing with cable Liaison from the accu/battery to the motor and Yield 07.50 seconds on down/open and 07.96 seconds on up/close using stopwards on a mobile phone.	 **Figure 4.3 Testing at the time of descending/opening the right front**

			 **Figure 4.4 Testing at the time of raising/closing the right front**
2.	Right rear power window regulator.	Test results on power regulators Window i.e. direct testing with cable Liaison from the accu/battery to the motor and Yields 05.62 seconds at the time of down/open and 05.87 seconds at the time of up/off using the STOPWARD on a mobile phone.	 **Figure 4.5 Testing at the time of descending/opening the right rear**
			 **Figure 4.6 Testing at the time of raising/closing the right rear**

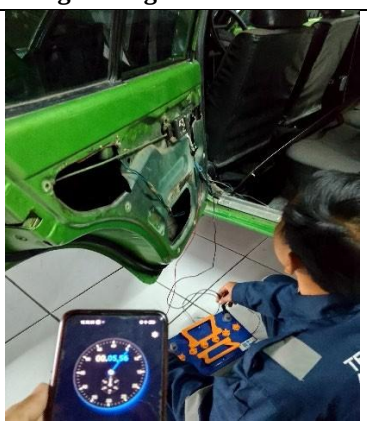
3.	Front power window regulator left.	Test results on power regulators Window i.e. direct testing with cable Liaison from the accu/battery to the motor and Yield 07.47 seconds at the time of down/open and 07.81 seconds at the time of up/close using the stopward on a mobile phone.	 **Figure 4.7 Testing at the time of descending/opening the left front**
			 **Figure 4.8 Testing at the time of rising/closing the left front**
4.	Left rear power window regulator.	Test results on power regulators Window i.e. direct testing with cable Liaison from the accu/battery to the motor and Yield 05.56 seconds at the time of down/open and 05.97 seconds at the time of the up/close using the stopward on a mobile phone.	 **Figure 4.9 Testing at the time of descending/opening the left rear**

			 **Figure 4.10 Testing at the time of rising/closing the left rear**

Power Window system maintenance

To keep the Power Window on the car in good condition or not, periodic maintenance is needed which aims to keep the components and performance of the Power Window in good condition.

The inspection of the components of the Power Window system is as follows:

a) Power Window switch check
b) Relay inspection
c) Fuse inspection
d) Regulatory checks
e) Checking the condition of the registry motor
f) Glass rubber inspection

PowerWindow must be given good and correct maintenance so that it can work properly and last. If there is a problem such as when the Power Window button is pressed but the rise or fall of the window glass has begun to stutter, or even jammed, usually we will realize the importance of caring for the Power Window.

In addition, often operating the Power Window, both on the front and rear window glass is also very good to be able to minimize the corrosion process on the Power Window motor. If maintenance is carried out routinely at least once every six months, it is guaranteed that the Power Window will work properly so that the safety and comfort factors are maintained.

Conclusion

From the results of the discussion, reports of symptoms or disturbances that often occur in the Power Window system are as follows:

1) All Power Windows don't work at all. This fault is caused by several possibilities such as: blown fuse, peeling wire, no connection to the wire or wire harness of the switch as well as connection to the connector of the ignition key assy.
2) One of the Power Windows cannot work. This disturbance often occurs, there are several possible causes such as: the Power Window switch is damaged, the cable is peeling, there is no connection or voltage entering the cable or wire harness of the switch, the motor is damaged.

3) Power Window gets stuck while working. This interference is caused by several possibilities such as voltage of a weak battery or loose connectors- connectors on the battery, insufficient voltage and current going into the motor, hardened glass list rubber, worn window regulator gears, faulty motor. For this reason, an inspection is carried out, if there are damaged components, they must be replaced if they are still suitable for use and need to be repaired

Suggestion

The suggestions that the author can convey in writing this Final Project are as follows:

1) Before operating the Power Window system during the practicum, students must first understand the system and components in the Power Window system. To understand the system and components of this tool, students can read the existing practice modules.
2) Students who do practicum using the Power Window system are expected to be able to operate this tool well and be careful so that this tool can last for a long time and can be used by students in the next year.

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