



Troubleshooting Analysis of the Cooling System in an Overheating Honda Jazz i-DSI Engine: A Case Study

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A B S T R A C T

This study analyzes the troubleshooting process of an overheating cooling system in a single Honda Jazz i-DSI engine used as a practical training unit at the Heavy Equipment Engineering Workshop, Politeknik Negeri Padang. A case study approach with descriptive analysis was applied through identification of overheating symptoms, inspection of cooling system components, functional testing, examination of coolant hose configuration, repair, and temperature verification. The inspection showed no blockage in the radiator, the V-belt met the inspection criteria, the thermostat opened at 80°C and fully opened at 95°C, and no mechanical damage was found in the water pump. The coolant level was low, while radiator cap pressure performance and temperature sensor accuracy were not quantitatively verified. Further inspection identified reversed inlet and outlet radiator hose installation. After correcting the hose configuration and refilling the coolant, the maximum coolant temperature decreased from 116.25°C to 95°C and subsequently decreased to 85°C. The findings indicate that incorrect hose configuration was associated with overheating in the investigated case.

K E Y W O R D S : Cooling System; Overheating; Troubleshooting; Radiator Hose; Honda Jazz i-DSI

1. INTRODUCTION

The cooling system is one of the main subsystems of an internal combustion engine that functions to maintain the engine operating temperature within the specified operating conditions. The system consists of several interconnected components, including the radiator, water pump, thermostat, cooling fan, radiator cap, cooling passages, and coolant. These components work together to circulate the coolant and dissipate the heat generated during engine operation. A properly functioning cooling system is required to maintain the engine temperature within a controlled range during the combustion process [1]. Overheating occurs when the engine temperature rises beyond the operating conditions that can be controlled by the cooling system. This condition can reduce engine performance and increase the risk of component damage if it persists. Excessively high temperatures can accelerate lubricant degradation, increase wear, and cause damage to engine components operating at high temperatures [2], [3]. Addressing overheating requires inspection to determine the condition of the cooling system and the factors associated with the increase in engine temperature. Various factors can cause engine overheating, including problems with the thermostat, water pump, radiator, cooling fan, hoses, coolant, and other cooling system components. The diagnostic process involves inspecting component conditions and conducting tests to determine

the source of the malfunction responsible for the increase in temperature. Systematic inspection is necessary because overheating symptoms may result from more than one condition within the cooling system [4], [5].

The cooling system operates by circulating coolant from the engine to the radiator and back to the engine through designated passages. Changes in the configuration or geometry of the coolant passages can affect flow characteristics and temperature conditions within the engine cooling system. This condition indicates that cooling system inspection should consider not only the physical condition of the components but also the proper installation and configuration of the coolant passages. Research specifically addressing improper hose installation as part of the troubleshooting process for engine overheating still needs to be strengthened. This consideration forms the basis of the present study for investigating possible malfunctions originating from the components and the configuration of the cooling system passages. Troubleshooting is an approach used to identify the causes of malfunctions through the stages of inspection, testing, analysis, and verification. A systematic troubleshooting process helps determine appropriate corrective actions based on the conditions identified in the system [6],[7]. This approach is appropriate for addressing overheating cases because each cooling system component needs to be inspected before the cause of the malfunction can be determined.

The Honda Jazz i-DSI engine used as a practical training unit at the Heavy Equipment Engineering Workshop, Politeknik Negeri Padang, experienced overheating during operation. This condition was indicated by an increase in engine operating temperature and prevented the engine from being used optimally as a practical training unit. Initial observations indicated that the cause of the overheating could not yet be determined because several possible factors were related to the condition of the components and the configuration of the cooling system. This study was conducted on a single Honda Jazz i-DSI engine through step-by-step inspection of the cooling system components and configuration to obtain evidence regarding the factors associated with the occurrence of overheating. Based on this problem, this study aims to analyze the troubleshooting process in an overheating case involving a single Honda Jazz i-DSI engine, identify the factors associated with overheating based on the results of component and cooling system configuration inspections, and evaluate changes in coolant temperature after the corrective action.

2. METHODOLOGY

This study was conducted to analyze the troubleshooting process in an overheating case involving the cooling system of a single Honda Jazz i-DSI engine used as a practical training unit at the Heavy Equipment Engineering Workshop, Politeknik Negeri Padang. A case study approach with descriptive analysis was employed to examine the actual engine condition, cooling system inspection results, corrective actions, and changes in coolant temperature after the repair. The study focused on identifying the factors associated with overheating based on the inspection results of the cooling system components and configuration.

The study was conducted in several stages to ensure that the identification of the causes of overheating was based on the actual engine condition and the inspection results obtained at each stage. The research stages included identification of overheating symptoms, cooling system inspection, analysis of the causes of overheating, cooling system repair, and cooling system verification. The relationship between the research stages is shown in Figure 1.

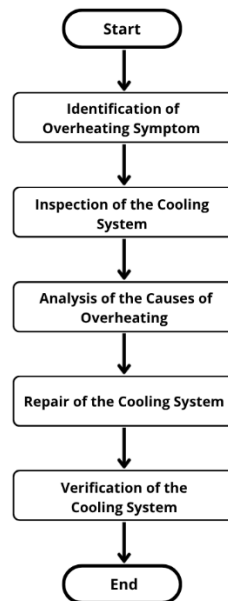


Figure 1. Flowchart of the Research Stages

The research stages were developed based on a troubleshooting approach to systematically investigate the causes of overheating in the cooling system of the Honda Jazz i-DSI engine. The cooling system consists of several components that operate in an integrated manner to control engine temperature; therefore, inspection needs to consider both the condition of individual components and the relationships among components within the system [8]. The troubleshooting process involved identifying the initial symptoms, inspecting the cooling system condition, analyzing the inspection results, implementing corrective actions based on the identified factors, and conducting verification after the repair. A systematic troubleshooting approach was used to guide the diagnostic process based on inspection and testing results rather than assumptions regarding a particular component [9], [10].

The research flowchart in Figure 1 consists of five main stages: identification of overheating symptoms, cooling system inspection, analysis of the causes of overheating, cooling system repair, and cooling system verification. Each stage was carried out sequentially, and the results of each stage were used as the basis for determining the actions in the subsequent stage.

1. Identification of Overheating Symptoms

The identification stage was conducted to obtain an initial overview of the condition of the engine experiencing overheating. The identification included observations of the overheating symptoms, temperature indicators, the initial condition of the cooling system, and information regarding the engine's operating and maintenance history. The initial information was used to determine the scope of the cooling system inspection and to direct the inspection toward factors potentially associated with the increase in temperature.

2. Cooling System Inspection

The inspection was conducted on the components and configuration of the cooling system that could potentially be associated with the occurrence of overheating. The components inspected included the coolant, coolant hoses, radiator, radiator cap, cooling fan, temperature sensor, V-belt, thermostat, and water pump. The inspection methods were adjusted to the characteristics of each component and included visual inspection, functional inspection, tension inspection, flow testing, and temperature testing. The inspection results for each component were recorded and used as the basis for determining the actual condition of the cooling system.

3. Analysis of the Causes of Overheating

The inspection results were then analyzed by comparing the actual condition of each component and the cooling system configuration with the conditions used as inspection references. The analysis was conducted to determine the factors most closely associated with the occurrence of overheating based on the evidence obtained from the inspection. The analysis considered not only the condition of individual components but also the compatibility of the relationships among components and the configuration of the coolant passages.

4. Cooling System Repair

Corrective actions were carried out based on the analysis results from the previous stage. The repair focused on the conditions identified during the inspection so that the corrective actions were not based on assumptions regarding component failure. In the investigated case, the corrective actions included adjusting the cooling system hose configuration and refilling the coolant to the specified level.

5. Cooling System Verification

Verification was conducted after the corrective actions to evaluate changes in the condition of the cooling system. The test was performed by measuring the coolant temperature under the engine operating conditions used in the study. The post-repair measurement results were compared with the pre-repair condition to determine changes in temperature and the overheating condition of the single engine investigated.

3. RESULTS AND DISCUSSION

3.1 Identification of Overheating Symptoms

The initial stage of the study showed that a single Honda Jazz i-DSI engine used as a practical training unit at the Heavy Equipment Engineering Workshop, Politeknik Negeri Padang, experienced overheating during operation. The symptom was indicated by an increase in coolant temperature to a high level, resulting in the engine being shut down. This initial condition provided the basis for further inspection of the cooling system to identify factors associated with the increase in temperature. Information regarding the engine maintenance history was also obtained during the identification stage. According to information provided by the workshop, the radiator cap and thermostat had been replaced before the overheating symptoms were observed. This maintenance history was used as supporting information during the diagnostic process. Previous replacement of these components could not be used to conclude that they were completely free from functional problems; therefore, the actual condition of each component still needed to be inspected.

The initial identification results were not sufficient to determine the cause of the overheating. The increase in temperature only indicated an abnormal condition in engine temperature control, while the contributing factors could be related to the coolant condition, cooling system components, or coolant passage configuration. Further inspection was required to obtain evidence regarding the condition of each part of the cooling system before analyzing the contributing factors. The initial identification results, including the overheating symptoms, temperature condition, initial action, and maintenance history, are summarized in Table 1.

Table 1. Initial Identification Results of the Problem

Parameter	Identification Results
Main symptom	The engine experienced <i>overheating</i>
Indication of abnormal condition	The <i>coolant</i> temperature reached a <i>too-high</i> level
Initial action	The engine was shut down (<i>engine shut down</i>)
Maintenance history	The <i>radiator cap</i> and <i>thermostat</i> had been replaced

3.2 Cooling System Inspection

The cooling system inspection was conducted to determine the actual condition of the components involved in controlling the engine temperature and to investigate factors that could cause overheating. The inspection covered the coolant, coolant hoses, radiator, radiator cap, cooling fan, temperature sensor, V-belt, thermostat, and water pump[11]. The inspection methods were adapted to the characteristics of each component and included visual inspection, functional testing, flow testing, temperature testing, and mechanical condition inspection. The inspection criteria were determined based on the physical condition of the components, functional test results, and the specifications provided in the Honda Jazz i-DSI engine inspection procedures. The inspection results for each cooling system component are presented in Table 2.

Table 2. Inspection Results of Cooling System Components

Component	Inspection Method	Inspection Criteria/Parameters	Inspection Results	Interpretation
Coolant	Level and visual condition inspection	Coolant level is within the specified filling condition	Coolant level was found to be low	Does not meet the specified filling condition
Coolant hose	Visual inspection	No leakage or physical damage	No leakage was found; the hose was slightly collapsed	No physical damage was identified
Radiator	Draining, disassembly, and flow testing	Water flow is not obstructed	No blockage was found	No flow obstruction was identified based on the test
Radiator cap	Visual inspection	No physical damage	Physical condition was good	Pressure function was not verified
Cooling fan	Visual inspection and running test	Fan operates during the test	The initial test showed that the fan did not operate; the test with the fan switched on still showed an increase in temperature	Fan operation alone did not explain the entire overheating condition
Temperature sensor	Visual inspection	No physical damage	No physical damage was identified	Sensor accuracy was not verified
V-belt	Deflection test using applied force	Applied force of 98 N; deflection of 7.5–10.5 mm for the belt condition under inspection	No abnormality was found in the belt condition or tension	Meets the inspection criteria
Thermostat	Temperature test in heated water	Begins to open at 80–84°C and fully opens at approximately 95°C	Began to open at 80°C and fully opened at 95°C	Meets the inspection specifications
Water pump	Circulation test and mechanical inspection	Circulation is present and no mechanical damage is identified	Bypass flow appeared slightly weak; no mechanical damage was found	No mechanical damage was identified

The coolant inspection showed that the coolant level in the radiator was low. This condition was identified during the initial inspection and documented in the student report. A low coolant level is an important finding because the coolant filling condition is related to the circulation process and temperature control of the engine. This study did not conduct a separate test by restoring the coolant level to the normal condition before correcting the hose configuration. Therefore, the effect of the coolant level on overheating could not be experimentally separated from the corrective actions performed at the subsequent stage. The low coolant level was retained as one of the factors that needed to be considered when interpreting the study results. The coolant hose inspection was performed through visual inspection to determine the physical condition and identify possible leakage. The inspection results showed no leakage, while the hose appeared to be slightly collapsed. These results indicate that no physically observable damage was found on the hose. The initial inspection did not include measurements of

coolant pressure or flow rate. Therefore, the physical condition of the hose could not be used to quantitatively assess the coolant flow characteristics.

The radiator inspection was performed by draining the coolant, disassembling the radiator, and conducting a flow test by introducing water through the radiator outlet. The test was conducted to determine whether any blockage could impede circulation. The inspection results showed that the radiator was not blocked based on the test method used. The drained coolant appeared slightly dirty. This finding was recorded as supporting information during the inspection but was not used to determine the radiator's heat transfer performance because the study did not measure flow rate, pressure, or heat transfer parameters. The radiator cap was inspected visually. Its physical condition appeared good and showed no visible damage. These inspection results provided information only about the physical condition of the radiator cap. The valve opening pressure and the ability of the radiator cap to maintain pressure were not tested in this study. Therefore, the statement that the radiator cap was in good condition was limited to its physical condition and did not include its pressure performance.

The cooling fan was inspected through observation of its physical condition and testing while the engine was operating. Visual inspection showed no physical damage to the fan. The initial running test showed that the coolant temperature continued to increase and reached 116.25°C, while the fan was recorded as not operating during the test. A subsequent test was conducted with the fan switched on. The coolant temperature continued to increase from 75.25°C to 112.75°C during the test. These results indicate that the temperature continued to increase when the fan was operated under the test conditions. These data provided the basis for further inspection of other components and the cooling system configuration. The temperature sensor was inspected visually. No visible physical damage was found during the inspection. The inspection was not accompanied by a comparison between the sensor reading and an independent temperature measuring instrument. Therefore, sensor accuracy relative to the actual temperature could not be determined from this study. The temperature data used in the subsequent analysis were treated as the recorded coolant temperature readings obtained during the running test.

The V-belt was inspected by applying a force of 98 N (10 kgf) at the inspection point. The V-belt deflection used as the inspection criterion was 7.5–10.5 mm, while the criterion for a new belt was 4.5–6.0 mm after the engine had been operated for five minutes and the belt had been readjusted. The inspection results showed no abnormality in the belt slack or physical condition. These results indicate that the V-belt met the inspection criteria used in the study. The thermostat was tested by measuring its temperature response while it was placed in water heated gradually. The inspection procedure used an opening temperature of 80–84°C and a full-opening temperature of approximately 95°C as the inspection parameters. The test results showed that the thermostat began to open at 80°C and reached full opening at 95°C. These results were within the specified inspection parameters, indicating no evidence of thermostat malfunction under the test conditions. The water pump was inspected through a circulation test with the thermostat removed. Water was introduced through the inlet hose, while the outlet hose was directed into a collection container, and the engine was then operated to observe the water discharge. The observation showed that the water circulation at the bypass section appeared slightly weak. A further inspection was conducted by disassembling the water pump to examine its mechanical condition. No damage to the water pump was found. These results indicate that no mechanical damage was identified in the water pump, while its coolant flow performance could not be quantitatively assessed because flow rate and pressure were not measured.

The inspection results showed that the condition of each component could not be assessed solely using a normal or abnormal classification. Some components were tested using specific parameters, such as the V-belt and thermostat, while other components were examined through visual inspection or qualitative testing. The radiator cap could not be assessed in terms of its pressure-retention capability, while the temperature sensor could not be assessed in terms of its reading accuracy. The low coolant level was also a finding that could not be excluded from the overheating analysis. The findings for each component were then used to determine the direction of the subsequent inspection. Further inspection focused not only on the physical condition of the components but also on the relationships among the components and the coolant passage configuration. Inspection during the assembly process identified an incorrect installation of the radiator inlet and outlet hoses. The two hoses were found to be reversed from their intended configuration. This configuration finding provided the basis for further analysis of the factors associated with overheating in the investigated Honda Jazz i-DSI engine.

3.3 Analysis of Factors Associated with Overheating

The analysis was conducted by comparing the component inspection results, temperature tests, and findings related to the coolant passage configuration of the Honda Jazz i-DSI engine. Previous inspections showed that the radiator was not blocked, the V-belt met the inspection criteria, and the thermostat operated within the temperature range used as the reference. The water pump showed no mechanical damage, while the water flow at the bypass section appeared slightly weak. The radiator cap and temperature sensor could only be assessed through physical inspection; therefore, the pressure function of the radiator cap and the accuracy of the temperature sensor could not be verified. The coolant level was also found to be low and remained a condition that could be associated with overheating.

The initial temperature test showed a continuous increase in coolant temperature. The temperature was recorded at 84.25°C at the beginning of the test, increased to 95°C at the third minute, reached 110°C at 4 minutes and 30 seconds, and reached a maximum of 116.25°C at 7 minutes and 30 seconds. These data indicate that the cooling system was unable to maintain the coolant temperature under the initial test conditions.

Table 3. Coolant Temperature Changes Under Initial Conditions

Time	Coolant Temperature (°C)
16:11:00	84.25
16:12:00	87.00
16:13:00	89.75
16:14:00	95.00
16:14:30	102.50
16:15:30	110.00
16:16:00	114.50
16:18:30	116.25

A test with the fan switched on was conducted to determine the temperature condition when heat dissipation through the fan was activated. The coolant temperature increased from 75.25°C to 93.25°C at the fifth minute, then increased to 99.25°C and 107.75°C, reaching 112.75°C at the end of the test. This temperature increase indicates that fan operation under the test conditions did not stop the increase in coolant temperature. These results provided a basis for continuing the inspection of other cooling system components and configurations.

Further inspection during the assembly process identified an incorrect hose configuration at the radiator. The inlet and outlet hoses were found to be reversed from their intended installation positions. The student report also recorded that this condition resulted from a previous installation error. This finding differed from the initial visual inspection because the physical condition of the hoses showed no leakage or visible damage, whereas the problem was identified in their installation configuration. This condition indicates the importance of examining the relationships among components and the coolant circulation path in addition to inspecting the physical condition of each component.

The repair was performed by returning the radiator inlet and outlet hoses to their correct configuration. The repair process was documented by comparing the conditions before and after the repair, as shown in Figure 2.



Figure 2. Comparison of Radiator Inlet and Outlet Hose Configurations Before and After Repair

The documentation provides visual evidence of the change in hose configuration, which was one of the main findings during the troubleshooting process. The coolant was also refilled after the assembly and hose repair process. The post-repair test showed a different temperature pattern from the initial test. The coolant temperature increased from 76.25°C at the beginning of the test to 95°C, then decreased to 92.75°C and 89°C, and subsequently remained within the range of 85–88.5°C until the end of the test. The lowest temperature recorded at the end of the measurement was 85°C. These data indicate that the temperature did not continue to increase after reaching approximately 95°C, unlike the condition observed before the repair.

Table 4. Comparison of Coolant Temperature Before and After Repair

Parameter	Before Repair	After Repair
Initial recorded temperature	84.25°C	76.25°C
Maximum temperature	116.25°C	95.00°C
Condition after reaching maximum temperature	Temperature remained high	Temperature decreased and remained within the range of 85–88.5°C
Temperature pattern	Continued to increase	Increased to approximately 95°C, then decreased and stabilized
Engine condition	Experienced overheating	Did not show a continuous increase in temperature

The comparison in Table 4 shows a change in the temperature pattern after the corrective action. The maximum recorded temperature decreased from 116.25°C before the repair to 95°C after the repair, while the temperature pattern changed from a continuous increase to a decrease followed by a relatively stable condition within the range of 85–88.5°C. This change provides supporting evidence that the corrective action was associated with an improved thermal condition of the engine during the post-repair test.

The interpretation of the temperature change needs to consider that the corrective action involved not only changing the hose configuration but also refilling the coolant. The coolant level was found to be low before the repair, while coolant refilling was performed as part of the corrective action. The effects of these individual actions could not be experimentally separated because the study did not include a controlled test with the coolant at the proper level while the hoses remained reversed. Therefore, the hose configuration is considered a factor associated with the change in the overheating condition rather than the sole factor experimentally demonstrated to have caused the overheating.

The temperature change after the repair supports the interpretation that the hose configuration was associated with the operating condition of the cooling system in the investigated engine. The incorrect hose routing may have affected the coolant circulation pattern within the system; however, this mechanism was not directly measured through coolant flow rate, pressure distribution, or heat-transfer parameters. Therefore, the interpretation of the flow mechanism is limited to the findings regarding the hose configuration and the temperature changes observed before and after the corrective action.

The analysis results show that the troubleshooting process narrowed down the possible factors associated with overheating in the single Honda Jazz i-DSI engine investigated. The component inspections did not indicate problems with the radiator, V-belt, or thermostat based on the tests performed, while further inspection identified an incorrect hose configuration. The post-repair test showed a change in the temperature pattern from an increase to 116.25°C to an increase to approximately 95°C followed by a decrease and a relatively stable condition within the range of 85–88.5°C. These results support the finding that the incorrect hose configuration was associated with overheating in the investigated case, while considering the effect of coolant refilling and the limitations of the tests performed on several components.

3.4 Verification of the Cooling System After Repair

The cooling system was verified to determine changes in the engine temperature condition after the corrective actions. The corrective actions included returning the radiator inlet and outlet hoses to the appropriate configuration and refilling the cooling system with coolant. The student report recorded that the two hoses had previously been found reversed during the assembly process and were subsequently returned to their correct positions. The post-repair test was conducted by operating the engine and recording the coolant temperature over time. The fan was operated when the temperature reached approximately 95°C, according to the testing procedure documented in the report.

The post-repair test showed that the coolant temperature increased from 76.25°C at the beginning of the measurement to 95°C at 12:34:30. The temperature then decreased to 92.75°C and 89°C and subsequently remained within the range of 85–88.5°C until the end of the test. The temperature recorded at the end of the measurement was 85°C. This pattern differed from the pre-repair condition, which showed an increase in temperature from 84.25°C to 116.25°C during the test. The coolant temperature measurement data after the repair are presented in Table 5.

Table 5. Comparison of Coolant Temperature Test Results

No.	Time	Coolant Temperature (°C)
1	12:30:00	76.25
2	12:30:31	80.50
3	12:31:00	83.75
4	12:31:30	86.25
5	12:32:00	88.50
6	12:32:30	89.75
7	12:33:00	91.50
8	12:33:30	92.75
9	12:34:00	94.00
10	12:34:30	95.00
11	12:35:00	92.75
12	12:35:30	89.00
13	12:36:00	88.50
14	12:36:30	88.50
15	12:37:00	87.75
16	12:37:30	86.00
17	12:38:00	86.25
18	12:38:30	85.00

Table 5 shows that the coolant temperature gradually increased from 76.25°C at the beginning of the measurement to 95°C at 12:34:30. The temperature then decreased to 92.75°C and 89°C and subsequently remained within the range of 85–88.5°C until the end of the measurement. The temperature recorded at the end of the test was 85°C. This pattern indicates that the coolant temperature did not continue to increase after reaching approximately 95°C. The change in coolant temperature after the improvement can be seen in Figure 3.

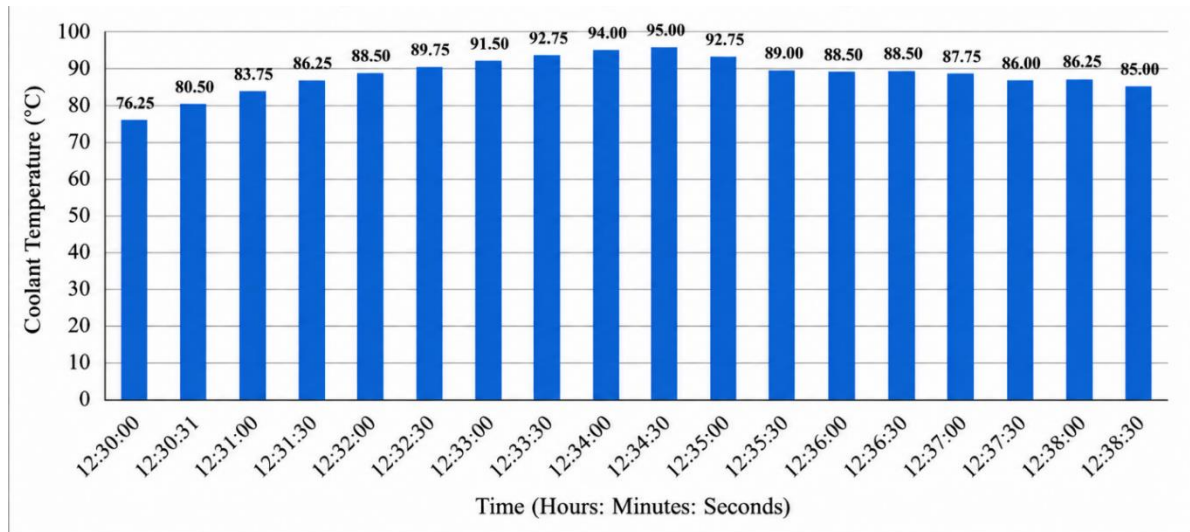


Figure 3. Change in coolant temperature after the improvement

The post-repair verification showed that the single Honda Jazz i-DSI engine investigated exhibited a change in temperature pattern, from an increase to 116.25°C before the repair to a maximum of 95°C after the repair, followed by a decrease to 85°C at the end of the test. These results support the finding that the cooling system condition became more controlled after the corrective action. The incorrect hose configuration was a factor associated with overheating in the investigated case, while the effect of the hose configuration independently of coolant refilling could not be determined based on the available test design.

3.5 Implications of the Troubleshooting Results

The troubleshooting results for the single Honda Jazz i-DSI engine show that overheating inspection needs to consider both component conditions and coolant passage configuration. The inspection of the radiator, V-belt, and thermostat showed no indication of malfunction based on the test methods used, while the water pump inspection found no mechanical damage. The coolant level was found to be low and remained a factor considered in the analysis, while the inspection of the radiator cap and temperature sensor was limited to their physical condition. These results indicate that individual component inspection alone did not provide sufficient explanation for the increase in engine temperature. The findings are consistent with a diagnostic approach in which several components are inspected to narrow down the possible sources of malfunction. The difference in this study lies in the subsequent finding of an incorrect configuration of the radiator inlet and outlet hoses in the investigated engine[12].

Further inspection found that the radiator inlet and outlet hoses had been installed in reversed positions. This condition was not identified during the initial visual inspection because the hoses showed no leakage or visible physical damage. This finding indicates that coolant passage configuration should be considered during troubleshooting when the physical condition of the components does not adequately explain the overheating symptoms[13]. Previous research on coolant passage geometry can be used to support the relationship between passage configuration and the thermal or flow characteristics of the system, while the present study demonstrates its application in troubleshooting an actual engine.

The repair was performed by returning the radiator inlet and outlet hoses to the appropriate configuration and refilling the coolant. The post-repair test showed that the coolant temperature increased to 95°C, then decreased and remained within the range of 85–88.5°C until the end of the test. This condition differed from the pre-repair test, in which the temperature increased to 116.25°C. This change is consistent with previous research showing that cooling system conditions and coolant circulation characteristics are related to engine temperature control[14]. This study contributes to the context of overheating troubleshooting by including hose configuration

inspection as part of the fault investigation process. The finding of reversed hose installation and the change in temperature response after the repair provide supporting evidence that hose configuration was associated with the overheating condition in the single Honda Jazz i-DSI engine investigated. This relationship cannot be used to quantitatively explain the flow mechanism because the study did not measure coolant flow rate, pressure in the cooling passages, or heat transfer parameters.

The interpretation of the results also needs to consider that coolant refilling was performed together with the correction of the hose configuration. The coolant level was found to be low before the repair; therefore, the effects of the hose configuration and coolant refilling could not be separated through a controlled test. This condition represents a limitation of the study and prevents the results from being used to state that the hose configuration was the sole cause of overheating. This study shows that, in the case of the single Honda Jazz i-DSI engine investigated, a troubleshooting process that proceeds from component inspection to examination of the coolant passage configuration can identify a hose installation condition requiring correction. The decrease in maximum temperature from 116.25°C before the repair to 95°C after the repair provides supporting evidence of an improved temperature condition following the corrective action. The findings remain limited to the investigated case because the effect of the hose configuration has not been separated from the effect of coolant refilling and has not been supported by quantitative measurements of flow characteristics.

4. CONCLUSION

This study analyzes the troubleshooting process in an overheating case involving a single Honda Jazz i-DSI engine used as a practical training unit at the Heavy Equipment Engineering Workshop, Politeknik Negeri Padang. The inspection was conducted on the cooling system components and configuration. The inspection results showed that the radiator was not blocked, the V-belt met the inspection criteria, the thermostat began to open at 80°C and fully opened at 95°C, and the water pump showed no mechanical damage. The coolant level was found to be low, while the pressure function of the radiator cap and the accuracy of the temperature sensor could not be quantitatively verified. The main finding was an incorrect installation of the radiator inlet and outlet hoses, which were found to be reversed. The repair was performed by correcting the hose configuration and refilling the coolant. The coolant temperature increased to 116.25°C before the repair, whereas after the repair it reached a maximum of 95°C and decreased to 85°C at the end of the test. These results indicate that the temperature condition became more controlled after the repair. The incorrect hose configuration was a factor associated with overheating in the investigated case. The effect of the hose configuration alone could not be determined because coolant refilling was performed simultaneously with the repair, and coolant flow rate, pressure, and heat transfer were not measured. The findings are limited to the investigated case and are not intended for generalization.

AUTHORS' CONTRIBUTIONS

A., RC., FAA., and KA. contributed to the conceptualization of the study, methodology development, supervision, formal analysis, data validation, as well as writing the original draft and reviewing the manuscript. **H. and AI.** were responsible for investigation, data curation, formal analysis, data visualization, and preparation of the original draft. Meanwhile, **KA. and H.** contributed to conceptualization, methodology development, project supervision, project administration, and manuscript review and editing

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