

# MECHANIC ROSTER

## ACADEMY / STUDY BOOK

# Repeatable Diagnostic Workflow

Follow a disciplined process from complaint verification through testing, documentation, and post-repair confirmation.



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<https://mechanicroster.com/index.php/academy/diagnostic-workflow>

## How to use this book

Read the lessons, work each example, then complete the practice questions before checking the answer explanations. Write your evidence and next step in the exercises. Training examples are not vehicle service specifications.

Mechanic Roster Academy is independent.

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# Before you begin

Basic vehicle-system knowledge. Use supervised practice for live measurements and manufacturer procedures for the actual vehicle.

## Learning objectives

- Write a reproducible concern statement.
- Build a hypothesis-test plan instead of a parts list.
- Interpret evidence against a stated specification.
- Verify the original complaint and communicate diagnostic uncertainty.

## Course contents

Define the problem and preserve evidence

Choose tests that distinguish hypotheses

Measure, compare and reason from limits

Verify and deliver a complete diagnostic record

Worked shop cases / Practical worksheet / Practice assessment / Answer explanations / Further study

## Define the problem and preserve evidence

Diagnosis is a sequence of decisions supported by evidence. Start with the customer's words and separate them from your interpretation. "Will not start" could mean no crank, slow crank, normal cranking without firing, or starting then stalling. Each points to a different first investigation. Record frequency, operating temperature, weather, load, speed, warning messages and recent changes.

Confirm vehicle identity and configuration before selecting service information. Review history and relevant bulletins or campaigns without assuming that a known pattern proves this vehicle has the same fault. A bulletin may guide a test or updated procedure; it does not remove the need to verify applicability.

Preserve fault codes, status, freeze-frame or other relevant data before clearing. A diagnostic trouble code describes a monitored condition, not necessarily a failed part. A circuit code can involve power, return, wiring, control or the component itself. Keep customer statements, observed symptoms and stored data in separate fields so later conclusions remain traceable.

### Rewrite the complaint

Instead of "needs starter," write "intermittent no-crank after a hot soak; dash illuminates; no starter operation observed on this visit yet." This identifies both reported conditions and the current verification limit. It avoids selling a component before proving the cause.

Set the authorized diagnostic scope and update point. If a safe reproduction is not possible, choose an approved monitoring or controlled-inspection plan rather than creating risk to obtain a symptom.

### Translate a story into a testable concern

A useful concern statement includes the behavior, operating conditions, frequency and onset. "Runs badly" offers little direction. "Hesitates during light acceleration after a warm restart, twice this week, with no reported cold-start issue" supplies conditions to investigate. Record the customer's description without converting it into a component name. Ask about recent service and events without assuming they caused the fault.

Separate a symptom you observed from one reported but not reproduced. Both belong in the record, with their different evidence status. If safe reproduction is not possible, explain the limitation and choose a controlled next check. Do not manufacture a "confirmed" status to make the repair order look complete.

### Define success before testing

Write what a successful repair would change and how it could be checked. If the concern is intermittent, one normal observation may not be enough to establish resolution. Identify relevant duration and conditions without promising certainty that the available test cannot provide. Agree on the diagnostic scope and update point so investigation does not become unlimited unapproved work.

### Define the question before collecting data

A diagnostic work order should identify what the vehicle does, when it does it and what the customer expects instead. Separate an observation from a proposed cause. "Stalls after a hot restart" gives a condition to investigate; "needs a fuel pump" assumes the answer. Preserve relevant codes, freeze-frame information and service history before actions that may erase them.

List plausible hypotheses that fit the complaint and identify a test that could distinguish them. A test is useful when different results would change the next action. Repeating a measurement that cannot separate the current possibilities may add numbers without reducing uncertainty. Document what remains unknown so the next technician does not interpret an untested assumption as a confirmed fact.

A diagnostic decision has four parts

- Question What condition are we trying to explain?
- Hypotheses Which causes remain plausible?
- Test What result distinguishes them?
- Decision What follows from each outcome?

### **Try it before reading the answer**

A code identifies a circuit. Why is “replace the named sensor” an incomplete plan?

### **Worked answer and reasoning**

The code identifies a monitored condition or area to investigate, not necessarily the failed component. The plan should use the applicable procedure to evaluate the circuit, operating conditions and competing causes before selecting a repair.

## Choose tests that distinguish hypotheses

List a small number of plausible causes based on system operation. For each, identify a test with an expected result and an alternate result that would reject or weaken the hypothesis. Choose tests for diagnostic value, access, safety and cost-not merely because the tool is already connected. Several fault codes may share one power or ground problem rather than represent several failed modules.

Trace the system path and use current service information to locate test points, operating conditions and limits. A scan-tool command showing “on” is not necessarily proof that the actuator received power or moved. Likewise, a sensor value that looks plausible at rest may fail under the operating condition that triggers the complaint.

### Fictional dim-lamp test plan

| Hypothesis       | Discriminating evidence                                          |
|------------------|------------------------------------------------------------------|
| Feed-path loss   | Loaded loss across the feed above the supplied limit             |
| Return-path loss | Loaded loss across the return above the supplied limit           |
| Load concern     | Correct supply at load, followed by the specified component test |

Do not change several variables at once unless the approved procedure requires it. If a result contradicts the theory, reassess the theory instead of altering the record. The purpose of a test is to learn, not to defend the first guess.

Write the next decision before performing the test: “If this path passes under load, move to the return test; if it fails, subdivide the feed.” That makes the investigation efficient and explainable.

### Build hypotheses that make different predictions

A list of parts is not yet a diagnostic plan. For each plausible explanation, state what you expect to observe and what would contradict it. If two explanations predict the same result from your next test, that test will not distinguish them. Seek a safe, efficient measurement or observation that separates the possibilities.

Codes and scan data can be valuable starting evidence. A code identifies a detected condition under a control system's logic; it does not always identify the failed component. Check associated conditions, applicable service information and the actual system configuration. A command shown as “on” is different from measured output. A substituted default value can also be different from a direct sensor measurement; understand the data description.

### Choose the next test by information value

Prefer a test that can eliminate a meaningful branch over one that merely repeats a known symptom. Consider access, risk, time, required equipment and the authorization boundary. Start with relevant basic conditions, but do not turn “check the basics” into a ritual unrelated to the fault. Explain why each chosen check belongs in this investigation.

## Use a decision table instead of a parts list

In this fictional example, a load is weak. One hypothesis is excessive feed-path loss; another is a load problem despite a satisfactory supply path. A loaded measurement across the feed can help distinguish the hypotheses when interpreted against the supplied procedure. An unloaded voltage reading alone may not discriminate between them.

Before testing, write the expected interpretation of a passing, failing or inconclusive result. This prevents the diagnosis from changing its criteria after the number appears. If the setup cannot reproduce the relevant condition, label the result limited or inconclusive instead of forcing it into pass or fail. A hypothesis is not proven merely because one alternative has been weakened.

Make every test change the decision

- Hypothesis
- Discriminating test
- Next decision

Use the result to narrow the next step, while preserving what the test cannot establish.

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### Fictional decision record

| Result                           | Supported next step                          |
|----------------------------------|----------------------------------------------|
| Feed loss exceeds supplied limit | Localize loss within the feed path           |
| Feed loss meets supplied limit   | Continue other relevant tests                |
| Operating load not reproduced    | Establish valid conditions before conclusion |

### Try it before reading the answer

A feed-path test passes. Does that prove the load itself is defective?

### Worked answer and reasoning

No. It supports the tested path under the stated conditions. Other relevant causes, including the return path or control behavior, may remain. Continue the applicable diagnostic process rather than converting one pass into a unique parts verdict.

# Measure, compare and reason from limits

A usable measurement contains the setup, test points, operating state, tool, reading, unit and reference. Match temperature, load, speed or other conditions specified by the procedure. A value taken at idle may not answer a fault that occurs under load; an unplugged connector may not reveal a weak current-carrying connection.

Use inclusive limits correctly. In a fictional exercise with an acceptable range of 4.8-5.2 V, 4.7 V is low and 5.0 V is within that range. Passing the voltage criterion is not proof that the entire component works. A signal may still fail a response, plausibility or timing test. State exactly which criterion passed.

Check tool condition and resolution near a boundary. If a reading changes when the probe is repositioned, first examine the connection and method before condemning the vehicle. If two tools disagree, resolve setup and tool suitability rather than selecting whichever value supports your desired repair.

## Evidence versus conclusion

Observation: the feed-path loss is 0.6 V under the stated load. Reference: exercise maximum 0.2 V. Interpretation: this path fails that criterion. Next action: segment the path to locate the loss. "Replace the controller" is not supported by that evidence alone.

Intermittent behavior requires a record of simultaneous conditions. Capture the change and what was happening, then design the next test. Avoid causal statements such as "customer damaged it" unless independent evidence genuinely establishes that conclusion.

## Control variables and preserve the baseline

Record the initial state before clearing information or changing parts. Keep relevant codes, conditions, measurements and customer observations together. When possible, change one meaningful variable at a time and repeat the same test. If temperature, load, connection position and component all change simultaneously, a normal result may not tell you which change mattered.

Use a test log: hypothesis, test method, expected result, actual result and next decision. Include units and references. A failed test may invalidate the setup rather than the component, so confirm that the instrument and procedure were suitable. A result outside a range is strongest when the range applies to this configuration and the measurement conditions match it.

## Know when to pause

If the evidence conflicts, the equipment is unsuitable or the task exceeds your competence, identify the gap and escalate. Additional diagnostic authorization may be needed. Replacing a part because the initial allowance has elapsed does not resolve the uncertainty; it transfers it into a potentially unnecessary repair. A clear update can explain progress, remaining branches and the proposed next test.

## Keep units, limits and uncertainty explicit

A reading should include the measured quantity, units, points, tool setup and operating condition. A supplied limit of 0.30 V is not comparable to a number recorded as “300” without units. Three hundred millivolts equals 0.30 V. Precision on the display does not eliminate uncertainty from setup, equipment or an unstable operating state.

The fictional table shows two readings under different loads. Do not average them and call the result a pass. First establish which condition the reference requires, then reproduce that condition. For a borderline value, follow the applicable procedure for repeatability and instrument capability rather than silently rounding it in the favorable direction.

## Fictional evidence comparison

| Test             | Reading | Condition                |
|------------------|---------|--------------------------|
| A                | 0.20 V  | Low operating load       |
| B                | 0.45 V  | Required operating load  |
| Supplied maximum | 0.30 V  | Applies to required load |

## Try it before reading the answer

Which reading controls the stated comparison? Why is averaging A and B inappropriate?

## Worked answer and reasoning

Test B is the comparable condition and exceeds the supplied 0.30 V maximum. Averaging unlike load states mixes different tests and does not show compliance under the required condition.

## Verify and deliver a complete diagnostic record

A repair is not verified merely because a new part is installed or a warning is cleared. Repeat the relevant safe operating conditions and the measurements that identified the fault. Confirm the affected function and inspect for secondary concerns. Where a procedure requires a relearn, calibration or monitor check, include it in the plan and record the result.

Compare before and after under equivalent conditions. A lower loss measured with the load off is not comparable to a loaded baseline. If the original concern was hot intermittent operation, a single cold start cannot establish full resolution. Document what was tested and any remaining limitation.

Present the customer with a concise chain: concern, evidence, cause to the extent established, authorized correction, verification, and follow-up. Preserve declined or pending findings separately. A diagnostic fee buys the agreed investigation; it should not be described as a guarantee of a particular inexpensive repair.

### Honest incomplete outcome

“We checked the documented feed and return under the stated conditions; both passed. The intermittent no-crank has not occurred during this visit. We recommend the next approved monitoring step and will update you before expanding the diagnostic time.” This is a useful result, not an excuse to invent certainty.

Close the record with sources and measurements that another technician can follow. Review whether the chosen tests actually distinguished causes. That reflection improves future decisions more than remembering which replacement part happened to work once.

### Verification should challenge the repair claim

Repeat the relevant pre-repair test under comparable conditions. Verify both the direct repair result and the original complaint. Check for introduced faults, required initialization and any disturbed connections or assemblies. A part replacement and a cleared code are events; resolution is a supported conclusion drawn from verification.

For an intermittent problem, state the conditions and duration of the successful check. “No recurrence during the documented warm restart sequence” is more defensible than “will never happen again.” If the symptom remains, reopen the appropriate diagnostic branch rather than rationalizing the result. Preserve failed hypotheses in concise form; they help prevent the next technician from repeating the same work without reason.

### Close the customer loop

Explain the concern, evidence, authorized correction and verification in plain language. Separate findings from recommendations that were not completed. Give an owned next step for unresolved issues. Good diagnostic documentation allows another qualified person to understand how the conclusion was reached, not merely which part number appeared on the invoice.

## Verify the causal chain and leave a useful record

A repair result should connect the initial concern, evidence, authorization, correction and verification. A code that no longer appears immediately after clearing is weaker evidence than completing the relevant verification under the required conditions. If the complaint was intermittent, describe the duration and conditions of the final check rather than promising the issue can never recur.

Record open questions and the next decision owner. A good handoff avoids both overconfidence and vagueness: identify what was tested, what changed, what passed its reference and what remains untested. This makes further work efficient and helps the customer understand why a diagnostic stage may be complete even when an additional decision is still needed.

The final diagnostic note

- Evidence Initial condition and relevant findings
- Work Approved correction tied to evidence
- Verification Comparable checks and results
- Limits Unknowns and the next agreed step

## Try it before reading the answer

Rewrite “code gone; fixed” into a meaningful verification note.

## Worked answer and reasoning

Name the original concern, the performed correction and the prescribed verification completed under stated conditions. Include actual results and any remaining limitations. Clearing the code alone is an action, not proof the original fault is resolved.

## Work the shop cases

### Commanded on is not proven on

A customer reports an actuator not operating. Scan data shows an on-command. A technician concludes the actuator is defective without checking the relevant supply, return, control conditions or physical output. Another technician suggests clearing codes first because the screen looks complicated.

Build two plausible hypotheses and a test sequence that distinguishes them. State what evidence should be retained before changing the state.

Your evidence, decision and next step:

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### Compare with the model answer

Possibilities include a load that cannot respond and a circuit/control condition that prevents the intended response. Preserve relevant codes, command state, operating conditions and observed output. Use the correct circuit and procedure to verify whether the required conditions reach the actuator, then assess its response. A displayed command alone does not distinguish those branches. Clearing information before recording it may remove useful context. The sequence should produce a component recommendation only after the relevant conditions and test results support it.

### An intermittent concern disappears after several changes

A warm-only fault was observed. The technician allowed the vehicle to cool, moved a harness, cleared codes and replaced a component. The vehicle now passes a cold check. The invoice says the new component permanently fixed the concern.

Identify the uncontrolled changes, revise the verification statement and propose a more informative follow-up test within authorization and safety limits.

Your evidence, decision and next step:

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### Compare with the model answer

Temperature, harness position, stored information and component condition all changed. The cold pass cannot identify which change affected the warm symptom. Preserve the work already performed, avoid an unsupported permanent-cure claim and repeat the relevant warm conditions through a safe prescribed test. Inspect the disturbed harness and other evidence as appropriate. A defensible note describes the current result and the remaining verification gap. Future tests should control the relevant variables and document the prediction before the result is known.

## Apply it to a job

Choose a fictional no-crank or dim-lamp complaint. Write reported versus observed conditions. Build three hypotheses with a confirming and disconfirming result for each. Complete a measurement row with units and a supplied limit. Write both a verified-repair handoff and an inconclusive-diagnosis update without promising an unsupported cure.

### Concern / scenario

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### Observation, measurement and reference

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### Interpretation and next action

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### Unknowns and who needs to review

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### Verification and handoff

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## Check your understanding

- Write a reproducible concern statement.
- Build competing hypotheses with different predicted results.
- Choose a discriminating test rather than a parts guess.
- Preserve a baseline and control variables.
- Write a verification conclusion whose certainty matches the evidence.

## Practice assessment

Ungraded practice, separate from the final assessment. Answers and reasoning follow in the next section.

### 1. A customer says the engine will not start. What must be clarified first?

- A. Whether it does not crank, cranks slowly or cranks without starting
- B. Which starter to order
- C. Which injector to replace
- D. Which code to clear

### 2. A test result contradicts the initial theory. What follows?

- A. Change the reading in the record.
- B. Revise the hypothesis and choose the next evidence-based test.
- C. Replace the suspected part anyway.
- D. Ignore all later data.

### 3. A supplied range is 4.8-5.2 V and the reading is 4.7 V. What is established?

- A. The controller is definitely failed.
- B. Every sensor is failed.
- C. This voltage criterion fails under the stated conditions.
- D. The whole system passes.

**4. A hot-only complaint is checked only during a cold start. Is verification complete?**

- A. Yes if no code appears.
- B. Yes if a part is new.
- C. Only the invoice decides.
- D. No; the original relevant conditions remain untested.

**5. 450 mV expressed in volts is what?**

- A. 0.45 V
- B. 4.5 V
- C. 45 V
- D. 0.045 V

**6. An operating condition cannot be reproduced. How should that test be labeled?**

- A. A universal pass
- B. Limited or inconclusive for that condition
- C. A unique component failure
- D. Proof the customer is mistaken

**7. Which record best supports a repair outcome?**

- A. Part replaced only
- B. Code cleared only
- C. Baseline, correction, comparable verification and remaining limits
- D. Invoice paid only

**8. What should be preserved before clearing diagnostic information?**

- A. Only the proposed part number
- B. Only the final estimate
- C. Only the technician's initial guess
- D. Relevant codes and operating data

# Answer explanations

## 1. Whether it does not crank, cranks slowly or cranks without starting

The complaint covers different conditions. Parts and clearing decisions require a defined problem.

Review: Define the problem and preserve evidence

## 2. Revise the hypothesis and choose the next evidence-based test.

Contradictory evidence is useful; forcing agreement defeats diagnosis.

Review: Choose tests that distinguish hypotheses

## 3. This voltage criterion fails under the stated conditions.

The comparison is specific. It does not uniquely establish which component caused it.

Review: Measure, compare and reason from limits

## 4. No; the original relevant conditions remain untested.

A different condition cannot prove the hot intermittent concern is resolved.

Review: Verify and deliver a complete diagnostic record

## 5. 0.45 V

Divide millivolts by 1000.

Review: Measure, compare and reason from limits

## 6. Limited or inconclusive for that condition

The absence of the required test condition limits interpretation.

Review: Choose tests that distinguish hypotheses

## 7. Baseline, correction, comparable verification and remaining limits

The evidence chain connects work to the customer's concern.

Review: Verify and deliver a complete diagnostic record

## 8. Relevant codes and operating data

Clearing may remove evidence needed for the diagnostic process.

Review: Define the problem and preserve evidence

## Further study

Use current vehicle and equipment information for actual service. These resources support further learning; lessons and questions in this book are original.

### **ASE automobile diagnostic task outlines**

[https://www.ase.com/wp-content/uploads/ASE\\_Automobile\\_Study\\_Guide.pdf](https://www.ase.com/wp-content/uploads/ASE_Automobile_Study_Guide.pdf)

### **Fluke measurement and troubleshooting overview**

<https://www.fluke.com/en/learn/blog/digital-multimeters/common-automotive-testing-with-a-multimeter>