Answer key and coaching notes

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Answer key and coaching notes

Use after attempting the learner practice.

OPEX LEARNING RESOURCES / FICTIONAL TEACHING CASES

Compare the reasoning, not just the final number. These are sample responses and explicit fictional calculations; many bounded local designs can be valid when their evidence and controls are clear.

13 workplace cases and 68 detailed method lessons. One habit: make the condition clear, choose a useful test and verify the response.

Use this resource with the individual OPEX sample reports and the separate teaching cards. Existing case figures are authored examples. Additional calculations are marked new fictional exercises. Blank records must be completed from an actual authorized observation or a clearly labelled role-play.

Evidence stays separate. A generated image, posted checklist or filled training sheet does not establish a completed improvement, safe operation or a Sustain score.

Read the case, use the practice, then take one bounded next step with the people doing the work. Preserve approved work, privacy and technical controls.

Open the OPEX example library | Open the training library

Stop the recurring leak

8D + cause verification

SAMPLE ANSWERS / MANUFACTURING-8D

CORE QUESTION

A fixture association is visible. Is that enough to select permanent corrective action?

Reasoned answer: No. Use it to select a discriminating test; preserve containment while checking the cause and the detection gap.

COMPANION QUESTION

What is the difference between relabelling or repairing affected units and changing the cause?

Reasoned answer: The first corrects those units; corrective action changes a verified cause and requires an effectiveness check.

A DEFENSIBLE WORKSHEET RESPONSE

1. Problem: 144 first-test failures / 2400 valves over the synthetic ten-day window. The specific mechanism remains unverified.

2. Contain affected lots under the existing authorized holding/release process. A repair of affected units alone does not remove a cause.

3. Occurrence hypothesis: presentation permits seal twisting. Escape hypothesis: the approved check may miss relevant conditions. Test each with an approved protocol and comparable conditions.

4. Fixture A 110/1200 and B 34/1200 are association clues. Retain operator/material/time mix and contrary observations.

5. Planned pilot: no more than 4/300 first-test failures and no new mode. Full comparable validation: no more than 36/2400. Neither is an achieved result.

Accept alternatives when: Quantifies product, defect, period and denominator. Separates occurrence and escape hypotheses and predicts a discriminating comparison. Keeps containment until the authorized effectiveness gate is met.

Sources: Q05, Q10, Q11 | Case

Make referrals ready

A3 thinking + administrative gemba

SAMPLE ANSWERS / HEALTHCARE-A3

CORE QUESTION

Which A3 link is missing if the team proposes a new intake form without observing rework?

Reasoned answer: The evidence connecting the current condition and its causes to the countermeasure.

COMPANION QUESTION

Why keep the reopened-case measure beside the readiness goal?

Reasoned answer: A local improvement can transfer work or errors downstream; the balancing measure helps expose that.

A DEFENSIBLE WORKSHEET RESPONSE

1. Current condition: 38 of 100 packets require rework or rerouting; readiness is 62%. Median receipt-to-confirmation is 4.8 business days.

2. The 21 missing-document cases justify examining when/how completeness is checked; they do not prove that a new form will solve the problem.

3. Test one agreed intake-readiness check and consolidated clarification on one channel, with comparable case mix.

4. Goals: at least 90% ready, median no more than 2 business days. Track reopened cases against the existing 8% ceiling.

5. Review actual timestamps, readiness, reopening and practitioner comments; revise if delay moves upstream or downstream.

Accept alternatives when: Uses one administrative boundary and a named owner. Connects current condition, target, analysis, trial and follow-up. Protects the reopened-case balance alongside readiness and lead time.

Sources: Q04, Q07, Q03 | Case

Send the right shipment

DMAIC + measurement + control

SAMPLE ANSWERS / LOGISTICS-DMAIC

CORE QUESTION

If one shipment has two errors, can it be counted twice in the 4% shipment measure?

Reasoned answer: No. Count it once as an error-containing shipment; a separate defects measure would need its own definition.

COMPANION QUESTION

Why is a Pareto bar not a root-cause conclusion?

Reasoned answer: It ranks recorded categories; it does not establish the mechanism causing them.

A DEFENSIBLE WORKSHEET RESPONSE

1. The measure is shipments with at least one confirmed content/label error divided by audited shipments: 120/3000 = 4%.

2. Primary categories 66 wrong SKU, 36 short quantity and 18 wrong label sum to 120. They prioritize investigation.

3. Location groups: 90/1000 = 9% and 30/2000 = 1.5%; differing order mix could explain part of the association.

4. Trial a clearer cue/location under comparable conditions. Keep the proposed error goal at 1% and throughput at least 220 lines per labour-hour.

5. Reaction plan names who checks the signal, contains affected work where authorized, investigates and verifies response. The target is not a statistical control limit.

Accept alternatives when: Defines unit, error, denominator and window. Separates association from mechanism and proposes a bounded trial. Names a reaction owner and protects at least 220 lines per labour-hour.

Sources: Q06, Q10, S03 | Case

Find it. Use it. Reset it.

6S + routine + replenishment

SAMPLE ANSWERS / HOSPITALITY-6S

CORE QUESTION

What would distinguish a completed tidy-up from evidence of Sustain?

Reasoned answer: Repeated comparable checks, response to misses and verified follow-through across operating conditions.

COMPANION QUESTION

Can a tidy shelf photograph establish the right replenishment minimum?

Reasoned answer: No. Demand, replenishment timing, usable inventory and local constraints are needed.

A DEFENSIBLE WORKSHEET RESPONSE

1. A useful reset describes locations, quantities, clean/inspect conditions, responsible role and the response when stock is missing or wrong.

2. A single tidy-up or posted sheet cannot establish Sustain; repeated checks, misses and verified responses are needed.

3. The retained retrieval sample median is 126 seconds across 20 tasks, with a proposed 60-second goal.

4. Separate fictional inventory exercise: usable on-hand 34 + confirmed on-order 6 - backlog 0 = position 40. At minimum 40, replenish to 70: order 30.

5. Real stocking settings require demand, lead time, variability, expiry/local requirements and pack rules. The sample quantities are not pantry recommendations.

Accept alternatives when: Names item identity, home, reset owner and abnormality response. Treats 126 seconds and 60 seconds as baseline/goal, not before/after results. Computes the separate exercise as 30 additional units and explains its assumptions.

Sources: F16, F09, F05, Q08 | Case

Shorten the handoffs

Lean + VSM + office flow

SAMPLE ANSWERS / SERVICES-VSM

CORE QUESTION

Does 36 minutes of touch time mean 36 minutes of customer value?

Reasoned answer: No. Touch time describes work duration; value requires a separate assessment of the activity.

COMPANION QUESTION

What must be recorded before claiming the future-state map worked?

Reasoned answer: Comparable actual end-to-end observations and balancing evidence, not only the proposed shorter route.

A DEFENSIBLE WORKSHEET RESPONSE

1. Queue total: 6.4+13.6+11.2+8.8=40 hours. Touch: 8+12+10+6=36 minutes=0.6 hours; route estimate 40.6 hours.

2. A clarification route returns information upstream and can generate another queue; a one-direction map is incomplete.

3. The proposed future state totals 15 queue hours +35/60 processing hours =15.5833 hours, below the 16-hour goal but unmeasured.

4. Complete-at-first-review is 26/40=65%, with a proposed 90% goal. Do not trade shorter visible queues for hidden incomplete work.

5. Accept only comparable actual end-to-end records with completeness, rework and workload checks.

Accept alternatives when: Reproduces 40 hours queue + 0.6 hours touch = 40.6 hours. Shows forward work and backward information. Keeps 15.58-hour future state as an untested hypothesis and checks completeness/rework.

Sources: F07, F08, S01 | Case

Make tomorrow ready

Daily management + gemba + escalation

SAMPLE ANSWERS / CONSTRUCTION-DAILY-MANAGEMENT

CORE QUESTION

When is an issue closed: when an owner is assigned, or when the response is verified?

Reasoned answer: When the defined response and its effect are verified; assignment is only a commitment.

COMPANION QUESTION

What should the leader ask at the work?

Reasoned answer: What is the expected condition, what is happening now, what is stopping progress, and what support or next test is needed?

A DEFENSIBLE WORKSHEET RESPONSE

1. 82/120=68.33% completed as promised; at least 102/120 would meet the proposed 85% next-window goal.

2. An inspection-release prerequisite needs the approved release reference; a card or meeting does not provide authorization.

3. Escalation includes a named receiving role and response time, not merely an email sent.

4. The owner records the response and the receiving team verifies the defined readiness condition.

5. Recurring blockers become structured problem-solving work; urgent concerns do not wait for the next daily meeting.

Accept alternatives when: Defines commitment completion and keeps due/finished counts. Names prerequisite, owner, due point and receiving response. Closes only after verification, with immediate concerns using existing routes.

Sources: Q08, Q07, Q01 | Case

Make the morning easier

6S through a small PDCA experiment

SAMPLE ANSWERS / CAFE-RESET

CORE QUESTION

The shelf looks better but no one timed the task. Which part of the cycle is still missing?

Reasoned answer: Checking the prediction against comparable observations and balancing measures.

COMPANION QUESTION

What should be done if quicker retrieval creates more wrong selections?

Reasoned answer: Adapt the design and test again; speed alone is not the outcome.

A DEFENSIBLE WORKSHEET RESPONSE

1. The source gives a 95-second authored summary and 45-second goal, without a historical raw series. Do not manufacture that series.

2. A prediction might be that agreed homes reduce searching without increasing wrong selections; this is a proposed teaching example, not a result.

3. Use comparable complete tasks and a consistent boundary. Record errors and abnormal conditions rather than deleting slow observations.

4. If retrieval is faster but wrong selections rise, adapt and test again. Speed alone is insufficient.

5. The receiving shift should demonstrate the method and say how to respond to a missing/wrong item.

Accept alternatives when: States a small change, prediction and consistent task boundary. Uses actual blank-sheet observations with a quality balance. Makes an evidence-based keep/adapt/abandon decision and checks teach-back.

Sources: Q01, Q03, F10, F16, S02 | Case

Give the request a clear next step

Office management + ownership + pull

SAMPLE ANSWERS / OFFICE-HANDOFF

CORE QUESTION

Does putting every incoming request into In progress create flow?

Reasoned answer: No. It can hide overload; make capacity, ageing and blocked work visible and use an explicit pull rule.

COMPANION QUESTION

Can removing four handoffs be called an improvement without checking completion and rework?

Reasoned answer: No. Necessary decisions may have been lost or work transferred; verify the customer outcome.

A DEFENSIBLE WORKSHEET RESPONSE

1. The existing seven-handoff summary and three-handoff goal do not supply a measured detailed route. Trace it first.

2. A ready request has agreed minimum information; an accepted completion meets required decisions and receiving criteria.

3. Blocked work retains a next owner, reason and response rather than becoming an invisible side queue.

4. Pull starts work when the agreed capacity rule permits it. The appropriate WIP policy is local, not given in the case.

5. Removing transfers is useful only when necessary controls remain and completion/rework evidence supports the change.

Accept alternatives when: Defines a counted handoff and records the actual route. Makes one accountable next owner and blocked-work response visible. Preserves approvals and compares whole-request outcomes.

Sources: F08, Q07, Q01 | Case

A tool room ready for the next job

Tool readiness + clean/inspect/respond

SAMPLE ANSWERS / CNC-TOOL-ROOM

CORE QUESTION

Where should a tool go if its identity is known but its verification status is uncertain?

Reasoned answer: The defined hold or awaiting-verification route, with an owner, rather than the ready-tool home.

COMPANION QUESTION

What evidence would show the residue problem was addressed beyond wiping it up?

Reasoned answer: An authorized response to its source and a comparable recurrence check, with conditions and observation window recorded.

A DEFENSIBLE WORKSHEET RESPONSE

1. An identified tool with uncertain verification status follows the hold/awaiting-verification route, with an owner.

2. The 12 retained tool-search observations have median 6.5 minutes and a 2-minute goal. They do not measure reliability.

3. Record where/when residue recurs and perform only authorized checks. Maintenance investigates technical causes under existing controls.

4. An equipment record can include observed condition, trend, open defect, due work, responsible role and verified completion; no invented wellness percentage is needed.

5. A documented authorized source response plus comparable recurrence checks is stronger than a clean photo or completed cleaning rota.

Accept alternatives when: Preserves identity and verification status. Separates authorized routine care from maintenance-owned technical work. Names owner, response and comparable recurrence verification.

Sources: F01, F02, F03, S04 | Case

Give the press area a clear reset

Preparation readiness + TPM/OEE

SAMPLE ANSWERS / EXTRUSION-PRESS

CORE QUESTION

Does meeting the 4-minute search goal prove a 4-minute changeover?

Reasoned answer: No. Search is only one component; technical changeover has a different start/finish and controls.

COMPANION QUESTION

If the team removes planned downtime from the denominator after the event, is that improvement?

Reasoned answer: No. Definitions must remain consistent; investigate the underlying loss and report boundary changes transparently.

A DEFENSIBLE WORKSHEET RESPONSE

1. Retained preparation search median 9 minutes/10 observations, goal 4; it does not establish changeover duration.

2. The preparation list must preserve die/item identity, verified status and the authorized staging/handover boundary.

3. Separate synthetic OEE: A=360/450=.8; P=600 x.5/360=.8333; Q=570/600=.95; OEE=.6333.

4. Equivalent losses:90 stopped,60 speed,15 quality minutes; fully productive 285 of 450 minutes. These are classifications, not causal explanations.

5. Do not relabel excluded time after the event to improve the number; keep definitions and investigate the underlying event log.

Accept alternatives when: Keeps search, technical changeover and OEE distinct. Uses first-pass good output and consistent planned/run boundaries. Computes 63.33% and investigates losses without claiming a cause.

Sources: F01, F03, F04, F15, F18 | Case

Make the welding bay ready to work

Kit standard + quality at source

SAMPLE ANSWERS / FABRICATION-WELDING

CORE QUESTION

How does a shaped fixture location differ from a final visual inspection?

Reasoned answer: It may prevent an incorrect selection; inspection detects a condition. Neither should be claimed effective without a test.

COMPANION QUESTION

Is Operator careless an adequate causal statement?

Reasoned answer: No. Investigate the conditions, information, standard and system that shaped the action.

A DEFENSIBLE WORKSHEET RESPONSE

1. Retained kit-search median 8 minutes from 12 observations, proposed 3-minute goal; wrong-item prevention is a separate requirement.

2. A shaped home may prevent some wrong selections; a visual check detects conditions. Either needs a defined challenge test.

3. Example test: present a plausible wrong item or missing required item within an authorized simulation and check whether the mechanism prevents/detects it.

4. Mismatch routes to hold and a receiving owner. Release follows documented resolution and verification, not assignment alone.

5. Operator careless is not an adequate causal explanation. Examine information, method, environment and system conditions.

Accept alternatives when: States the correct identity/readiness condition and the specific error. Distinguishes prevention from detection and defines a test. Includes hold, response owner and verified release.

Sources: Q09, Q10, Q07, F10 | Case

Keep the assembly line ready for the next frame

Part readiness + synchronized flow + yamazumi

SAMPLE ANSWERS / WINDOW-ASSEMBLY

CORE QUESTION

Which arrow carries the request to replenish, and which carries the parts?

Reasoned answer: Information travels back from consumption; replenished material travels toward the using process.

COMPANION QUESTION

What remains to be checked after the bars fit below the takt line?

Reasoned answer: Safe feasible sequence, task transfer, variability, machine overlap, quality and actual end-to-end performance.

A DEFENSIBLE WORKSHEET RESPONSE

1. Retained component-search median 3.4 minutes from 20 observations, goal 1.5; it is not cycle time or takt.

2. Information goes back from consumption; verified material travels toward the using process.

3. The new exercise has 400 x 60/300=80-second takt; work loads 85/65/60. E4 return empty tote 10 seconds moves 1 to 2, giving 75/75/60 and total 210.

4. Check precedence, competence, walking, access, variability, machine overlap and quality before a real trial. The chart alone does not justify staffing changes.

5. At 6 units/pack, pitch 8 minutes. A-A-B-A-B repeated 10 times releases 180A+120B over 400 minutes if setup/capacity supports it.

Accept alternatives when: Defines signal, quantity, responding owner and identity check. Preserves element IDs and total work while computing 80-second takt. Keeps feasibility, quality and real performance unverified until trial.

Sources: F05, F06, F09, F11, F13, F14, F17, F19 | Case

A clearer start for every cut order

Stock identity + FIFO + SMED

SAMPLE ANSWERS / SAW-CUTTING

CORE QUESTION

What happens when the FIFO lane is full?

Reasoned answer: Use the agreed stop/escalation rule; do not add an untracked overflow pile.

COMPANION QUESTION

Can all cleaning or adjustment be moved to while the machine runs to shorten downtime?

Reasoned answer: No. Follow task-specific authorization and energy controls; only genuinely safe, approved external preparation can move.

A DEFENSIBLE WORKSHEET RESPONSE

1. Retained order-preparation search median 4.8 minutes/15 observations, goal 2; no measured changeover dataset exists.

2. Full FIFO triggers the defined stop/escalation rule, not an untracked overflow area. Domain priorities can override simple arrival order only through explicit policy.

3. Uncertain grade or identity follows hold with a responsible owner; a new label cannot establish unknown material facts.

4. SMED studies internal and external work. Only technically safe authorized preparation moves outside the controlled change; single minute means single-digit aspiration, not one minute.

5. Observe last-good to first-good consistently and verify approved first output; no invented saw parameter or scrap cutoff is needed.

Accept alternatives when: Maintains identity and finite-capacity response. Defines consistent last-good to first-good change boundary. Moves only safe approved external preparation and verifies the resulting method.

Sources: F06, F12, S04 | Case

OEE: reconcile the factors and minutes

ANSWER / new fictional exercise, not extrusion-press measurements

Factor	Calculation	Answer
Availability	360 /450	80.00%
Performance	(600 x 0.5) /360	83.33%
First-pass quality	570 /600	95.00%
OEE	0.8 x(5/6) x 0.95	63.33%

Cross-check:570 first-pass-good x 0.5 ideal minutes /450 planned minutes =285/450=63.33%.

Equivalent time	Minutes
Stopped:450-360	90
Speed loss:360-(600 x 0.5)	60
Quality loss:(600-570)x 0.5	15
Fully productive:570 x 0.5	285
Total	450

The largest equivalent loss in the exercise is downtime,90 minutes. That identifies a class to investigate, not its root cause. Review event definitions, timestamps and operating context. If a required denominator is zero or undefined, do not force a percentage.

Common error: counting reworked pieces as first-pass good or redefining planned time after seeing the result. Sources: F04, F18.

Yamazumi: move the same element, not missing work

ANSWER / new fictional exercise; human work content remains 210 seconds

Takt =400 x 60/300 = **80 sec/unit**. Current 85/65/60; proposed 75/75/60.

ID / work element	Seconds	Current > proposed station
E1 / Position frame	30	1 > 1
E2 / Prepare corner kit	25	1 > 1
E3 / Confirm fixings	20	1 > 1
E4 / Return empty tote	10	1 > 2
E5 / Prepare seal kit	25	2 > 2
E6 / Check component identity	20	2 > 2
E7 / Record job reference	20	2 > 2
E8 / Check frame readiness	30	3 > 3
E9 / Confirm kit identity	20	3 > 3
E10 / Acknowledge handoff	10	3 > 3

E4, return empty tote, is the only 10-second transfer from station 1 to 2. Station 1:85-10=75. Station 2:65+10=75. Station 3 stays 60. Both sums equal 210.

A valid sketch preserves every element ID and duration in both sets of stacks. Use an 80-second reference line and distinguish proposed from observed work. Do not substitute a mean of the three totals for the constrained station.

Feasibility is unverified: check precedence, access, walking, skill, variability, machine overlap and quality. Neither the bars nor 210/80 justify a staffing change. Sources: F10, F11, F13.

Min-max: do not order the pending units twice

ANSWER / new fictional continuous-review policy

Inventory position =34 usable on-hand +6 confirmed on-order -0 unfilled demand = **40 units**.

The at-or-below 40 trigger is met. Additional order = target maximum 70 - inventory position 40 = **30 units**. Position after authorizing this order is 70, including the pending 6.

Mistaken decision	Why it fails
Order 36 =70-34	Ignores the 6 already on-order; position becomes 76.
Count held material as usable	Overstates stock available to meet demand.
Use 70 as a universal stock maximum	No local demand, lead-time, variability or pack evidence supports that recommendation.
Reorder again before checking open orders	Duplicates replenishment rather than responding to actual use.

This exercise has no backlog and no pack-rounding constraint. A real policy must define both, along with stock accuracy, expiry/criticality, review timing, ownership and exception handling. A periodic review needs to account for review delay.

A separate explanatory sizing assumption uses 30 expected units in a 40-minute replenishment loop plus a hypothetical 10-unit buffer. These assumptions illustrate the policy; they are not validated pantry needs. Sources: F09, F20.

Heijunka: reconcile mix, pitch and shift totals

ANSWER / new fictional 400-minute release plan

Pitch =80 sec/unit x 6 units/pack =480 sec = **8 minutes per pack**.

Quantity	Calculation	Answer
One A-A-B-A-B sequence	5 packs x 6	30 units
One sequence duration	5 slots x 8 min	40 min
Ten repeats	50 packs x 6	300 units
A output	3 A packs x 10 x 6	180 units
B output	2 B packs x 10 x 6	120 units
Total time	10 sequences x 40 min	400 min

The mix is 60% A and 40% B, matching the declared 180/120 demand. Each slot is a release of an agreed pack, not a command to every upstream operation to produce independently.

Feasibility still needs material, setup, process capacity and actual demand checks. Consumption authorizes refill. If supply is missing or a FIFO lane is full, use the declared response rather than push overflow or hide missed demand.

Common error: treating 8 minutes as a unit cycle, multiplying 300 by pitch, or ignoring the ten-repeat boundary. Sources: F14, F17, F19.

Office transfer: waiting changes, effort does not

ANSWER / deterministic fictional exercise under the stated assumptions

Policy	Stage 1 work	Stage 2 work	Stage 3 work
Whole batch	0-12 min	12-24 min	24-36 min
One-request transfer	0-12 min	2-14 min	4-16 min

Whole batch: first finishes **26 min**, last **36 min**.
One-request transfer: first **6 min**, last **16 min**.
Both require 6 requests x 3 stages x 2 min = **36 person-minutes**.

Under whole-batch transfer, stage 3 starts the first request at minute 24 and finishes it at 26; the sixth finishes at 36. With one-request transfer, stage 2 starts at 2 and stage 3 at 4; completions occur at 6,8,10,12,14 and 16.

Dedicated specialists overlap their work earlier. The 20-minute reduction in first and last completion is not 20 person-minutes removed, a staffing saving or a promise for real office work.

Conditions that could change the result include unequal service times, rework, interruptions, setup, limited shared capacity, arrival variation, required review batches and legitimate urgency rules. Preserve necessary approvals when testing actual requests.

Sources: F07, F08. This exercise does not supply the missing seven-step route in the retained office case.

Coach the next attempt

A wrong answer is useful when it reveals the mistaken assumption.

If the learner...	Ask them to...
Gets the number with unclear units	Write units on every input and convert before adding or multiplying.
Treats a goal or image as a result	Point to actual observations, evidence status and the comparable check still needed.
Chooses a fix from an association	Predict a discriminating observation and a result that could challenge the explanation.
Optimizes a local measure	Trace the end-to-end outcome and one balancing measure.
Closes on assignment	Name the receiving owner, response and verification that permits closure.
Applies an exercise as a local rule	State the assumptions and identify which must be checked with the responsible team.

A correct classroom calculation is not work authorization. Return to the actual condition with the responsible people, use the current approved method and define a bounded learning test.

Method sources and further reading

References 1-18 of 36

Q01 ASQ - Plan-Do-Check-Act Cycle

Q02 The Deming Institute - PDSA Cycle

Q03 Institute for Healthcare Improvement - Model for Improvement

Q04 Lean Enterprise Institute - A3 Report

Q05 ASQ - Eight Disciplines 8D

Q06 ASQ - DMAIC

Q07 Lean Enterprise Institute - Gemba

Q08 Lean Enterprise Institute - Reinforcing Lean Behavior Through Visual Management

Q09 Lean Enterprise Institute - Jidoka

Q10 ASQ - Fishbone Diagram

Q11 ASQ - Handbook of Corrective and Preventive Action, Sample

F01 Lean Enterprise Institute - Total Productive Maintenance

F02 Japan Institute of Plant Maintenance - 2023 TPM Award Outline, autonomous maintenance example

F03 NIST - Asset Condition Management: A Framework for Smart, Health-Ready Manufacturing Systems

F04 Tennessee Manufacturing Extension Partnership - OEE Implementation Guide

F05 Toyota Motor Corporation - Toyota Production System

F06 Lean Enterprise Institute - First In, First Out (FIFO)

F07 Lean Enterprise Institute - Value Stream Mapping

Original OPEX instructional designs informed by these sources. The fictional datasets and lesson timings are authored teaching choices, not recommendations quoted from source organizations.

Method sources and further reading

References 19-36 of 36

F08 Lean Enterprise Institute - Practicing Lean Fundamentals in an Office Environment

F09 NIST - Lean Manufacturing: Don't Leave Home Without It!

F10 Lean Enterprise Institute - Standardized Work

F11 Lean Enterprise Institute - Operator Balance Chart

F12 Lean Enterprise Institute - Single Minute Exchange of Die

F13 Lean Enterprise Institute - Takt Time

F14 Lean Enterprise Institute - Heijunka

F15 NIST - Research Suggests Significant Benefits to Investing in Advanced Machinery Maintenance

F16 US Environmental Protection Agency - Lean & Environment Toolkit, Chapter 5: 6S

F17 Lean Enterprise Institute - Pull Production

F18 ASQ - Quality Glossary: Overall Equipment Effectiveness

F19 Lean Enterprise Institute - Heijunka Box

F20 Lean Enterprise Institute - Inventory

S01 LEI: Lean Thinking and Practice

S02 CDC: Quality Training Standards

S03 ASQ: Control Chart

S04 OSHA: Control of Hazardous Energy

S05 OpenAI: GPT-Image-2.5 Flare

Original OPEX instructional designs informed by these sources. The fictional datasets and lesson timings are authored teaching choices, not recommendations quoted from source organizations.

Check your reasoning and transfer it

1. The customer gap is 6 complete quotes. Thirty drafts do not demonstrate fulfillment of 24 requests.

2. Follow the six freight approvals, their acceptance criteria and response capacity. Additional drafts may create more waiting without completing a quote.

3. A valid trial tests approval readiness and response coverage; measure issued correct quotes and waiting/overburden, not just draft count.

Suggested completed record

Item	Evidence	Conclusion
Customer	24 required; 18 issued	6 incomplete
Dependency	Freight approval	Named commercial approver
Trial	Ready information before issue	Check correct delivery and workload

Plausible wrong turns

1. TPS is not a list of isolated efficiency projects.

2. Removing a quality check to make work flow faster is not a demonstrated system improvement.

Evidence of a sound answer

1. Distinguish intermediate output from customer fulfillment.

2. Show both the response to abnormality and the replenishment/approval dependency.

3. Specify evidence that could disprove the proposed improvement.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Value-stream owner with process representatives
Record	One order trace, abnormality-response record and trial prediction
Review	At the next daily review and after the agreed trial cycle
Verification evidence	Verified delivery, unresolved holds, kit readiness and operator feedback
If unresolved	Escalate cross-department response gaps; revise the trial with evidence rather than adding local output targets.

Check your reasoning and transfer it

1. Wednesday leaves 5; Thursday starts with 5 plus 20 and leaves 10; Friday leaves 15 after processing 15 from 30.

2. The 60-request weekly load is below 75 theoretical weekly capacity, yet delayed release prevents earlier capacity from serving it.

3. Twelve ready requests released daily is a testable proposal if readiness and promises permit it. Validate mix, time per request and quality instead of treating the arithmetic as proven capacity.

Suggested completed record

Day / proposal	Calculation	Result
Wednesday	20 minus 15	5 waiting
Thursday	5 plus 20 minus 15	10 waiting
Friday	10 plus 20 minus 15	15 waiting
Proposed	12/day against 15/day	Test readiness and variation

Plausible wrong turns

1. Weekly average load does not show daily overburden.

2. Leveling does not justify delaying genuinely urgent work or ignoring variable task effort.

Evidence of a sound answer

1. Carry the queue forward correctly.

2. Distinguish the release policy from customer demand.

3. Include quality and worker experience in the trial review.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Release owner with service team leader
Record	Daily arrivals/releases/completions, queue age and workload observations
Review	Daily during a limited trial, then at the agreed service review
Verification evidence	Accurate completion with less induced waiting and no increase in strain or hidden work
If unresolved	Review readiness, real demand variability and trained capacity; retain explicit urgent-work rules.

Check your reasoning and transfer it

1. Takt is 360 x 60 / 240 = 90 sec/unit. The five observed intervals total 440 seconds, so their mean is 88 seconds.

2. Order K spans 30 elapsed calendar hours. That does not mean 30 hours of touch work.

3. One observed interval is 94 seconds, above takt, and five intervals are not a sufficient capability study. State the sample and investigate variation, losses and mix before promising performance.

Suggested completed record

Measure	Calculation / evidence	Result
Takt	21,600 / 240	90 sec/unit
Sample mean	440 / 5	88 sec
Observed range	82 to 94	One interval exceeds takt
Lead time	24 plus 6	30 calendar hours

Plausible wrong turns

1. A target is not an observed cycle time.

2. A mean below takt does not by itself establish reliable delivery.

Evidence of a sound answer

1. Use compatible periods and units.

2. Retain the 94-second observation and explain its implication.

3. Define the lead-time clock explicitly.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process owner with planning and trained observers
Record	Demand/net-time basis, repeated cycle sheet and order timestamp trace
Review	When demand or time basis changes, and after the agreed observation period
Verification evidence	Traceable definitions, representative observations and a decision consistent with variation
If unresolved	Keep capacity and promise claims provisional; obtain missing timing and route evidence.

Check your reasoning and transfer it

1. Batch stage intervals are 0-12, 12-24 and 24-36. First completion is minute 27 and last is 36.

2. Immediate transfer completes the first request at 9 minutes and the fourth at 18 minutes. There are 12 tasks of three minutes: 36 person-minutes in either schedule.

3. One person cannot perform the overlapping tasks shown on three worker lanes. A different staffing arrangement needs its own feasible schedule.

Suggested completed record

Alternative	Completion times, min	Work / decision
Full batch	First 27; last 36	36 person-min
Immediate transfer	First 9; last 18	36 person-min
One-person proposal	Overlapping lanes infeasible	Rebuild schedule

Plausible wrong turns

1. Elapsed minutes are not person-minutes.

2. The diagram does not prove that any physical process can run one piece at a time.

Evidence of a sound answer

1. Respect stage precedence and each worker's availability.

2. Reconcile all 12 tasks.

3. Separate the numerical model from a real trial claim.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process owner with the affected workers
Record	Before/proposed transfer schedule and observed trial record
Review	After a bounded trial covering representative request conditions
Verification evidence	Order completion timestamps, actual handling work, quality and worker feedback
If unresolved	Retain required processing constraints; revise the feasible transfer arrangement and rerun the comparison.

Check your reasoning and transfer it

1. Two distinct valid withdrawal requests permit two eligible eight-piece containers: 2 x 8 = 16 clips. The W11 copy is reconciled, not counted.

2. W11/H31/P31 and W12/H32/P32 are one acceptable allocation; reversing the two eligible containers is also valid if the trace remains consistent.

3. If H32 is held, only H31 can fulfill a request from supplied stock. Escalate the unfilled request and hold disposition; do not transfer H33 or manufacture an unauthorized card.

Suggested completed record

Request / variant	Container / status	Authorization and quantity
W11	H31 eligible	P31 returns; 8 clips
W12	H32 eligible	P32 returns; 8 clips
W11 copy	Duplicate	No second move or make
H32 held variant	Second request unfilled	Only 8 supplied from H31; escalate

Plausible wrong turns

1. A withdrawal card is not a production instruction.

2. A duplicate signal or quality hold does not automatically enlarge the authorized system.

Evidence of a sound answer

1. Trace item, quantity and both distinct permissions correctly.

2. Explain the held-stock branch without losing card identity.

3. Name the missing evidence and owner before proposing a system change.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Material-flow owner with quality and producing-process representatives
Record	One observed container/card trace and unresolved signal log
Review	At the next route review, then across representative replenishment cycles
Verification evidence	Matching identity/quantity, timely return, eligible stock status and no duplicate fulfillment
If unresolved	Escalate lost signals, hold delays or unreliable supply; revise the approved loop through its owner rather than adding informal cards.

Check your reasoning and transfer it

1. Initially 2 + 2 = 4, so S5 does not enter under the ordinary rule.

2. S2 completion reduces WIP to 3; admitting S5 restores 4. Neither blocked item disappears from the count.

3. A useful response checks the missing input with its owner. Moving a blocked card to a private list or marking it done without acceptance evidence does not create legitimate capacity.

Suggested completed record

Event	Counted requests	Count / decision
Initial	S1/S2/S3/S4	4; do not start S5
S2 complete	S1/S3/S4	3; one slot
S5 admitted	S1/S3/S4/S5	4; limit restored

Plausible wrong turns

1. Blocked work is not spare capacity.

2. A WIP limit is not a promise that every item has equal effort or urgency.

Evidence of a sound answer

1. Count blocked work consistently.

2. Link admission to a real completion.

3. Expose exception and blocker ownership.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Service team owner with cross-team approval counterpart
Record	Active-work history, blocker age, completion evidence and exception log
Review	At the daily work review and the agreed policy-learning review
Verification evidence	Honest WIP, improving completion/age and fulfilled acceptance criteria
If unresolved	Escalate repeated external waits; revise readiness, response or WIP policy with a visible hypothesis.

Check your reasoning and transfer it

1. Takt is 90 sec/unit and pitch is 360 seconds, or six minutes, per four-unit pack.

2. One A/B/B repeat produces 4 A and 8 B. Twenty repeats produce 80 A and 160 B, using 60 pitches x 6 = 360 minutes.

3. The calculation does not verify changeovers, material readiness or achievable quality at this mix.

Suggested completed record

Calculation	Intermediate result	Checked result
Takt / pitch	90 sec/unit	6 min/pack
One repeat	3 packs	4 A + 8 B
Twenty repeats	60 packs	80 A + 160 B; 360 min

Plausible wrong turns

1. Pitch is not the unit takt.

2. Meeting total volume does not establish correct product mix.

Evidence of a sound answer

1. Reconcile time, pack count and each product.

2. State what the supplied inputs cannot prove.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Planning owner with line and changeover representatives
Record	Mix/pitch plan, feasibility evidence and pitch exceptions
Review	At each planning-basis change and during the controlled trial
Verification evidence	Wanted units completed with valid quality status and feasible changeover conditions
If unresolved	Revise the release pattern or enabling conditions; do not use overproduction to make the board look complete.

Check your reasoning and transfer it

1. Unique instruments suggest a bounded, traceable FIFO or explicitly scheduled sequence; do not manufacture a supermarket of customer-owned repairs.

2. Repeat inserts can use defined replenishment stock. Adjacent verification/packing can test direct flow if all feasibility conditions hold.

3. A calibration queue limit needs lead-time and service evidence; a full queue must trigger controlled release and customer-response decisions.

Suggested completed record

Route	Choice	Condition / response
Customer instruments	Bounded traceable queue	Respect identity and agreed sequence
Packing inserts	Supermarket candidate	Usage/lead-time parameters needed
Verified instrument	Direct-flow candidate	Check readiness and safe transfer

Plausible wrong turns

1. FIFO is not limitless parking.

2. Not every repeated item automatically justifies a supermarket.

Evidence of a sound answer

1. Tie each choice to evidence rather than preference.

2. Name a real stop/escalation response.

3. Retain quality eligibility and customer identity.

Take the learning back to work

Commitment	Agreed follow-through
Owner	End-to-end material-flow owner
Record	Connection decision, declared limits and full/hold exception log
Review	After the limited trial and whenever mix or process constraints change
Verification evidence	Controlled WIP, preserved identity, reliable replenishment and known queue age
If unresolved	Revisit feasibility and parameters with both process owners; remove untracked overflow paths.

Check your reasoning and transfer it

1. The stated stock is three units, not two: machine 2 plus exit 1.

2. Takt remains 75 sec/unit, while actual cycle is unmeasured. Add the return route as observed rather than inventing its duration.

3. The owner must check feasibility, coordinate controlled instructions and verify the operator's demonstrated method before adoption.

Suggested completed record

Field	Evidence	Correction
Stock	2 + 1	3 units
Takt / cycle	75 sec/unit / unknown	Do not equate them
Return	Absent	Observe and draw
Revision	Not yet validated	Trial and teach

Plausible wrong turns

1. A list of steps is not the full route chart.

2. Standard in-process stock is not all inventory in the building.

Evidence of a sound answer

1. Reconcile stock locations to the total.

2. Preserve unknown measurements honestly.

3. Connect document revision to observed work and training.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process owner and trained operator representative
Record	Current/proposed chart, observed route and revision/training evidence
Review	During the method trial and at the agreed standard-work review
Verification evidence	Complete route, accurate stock positions and demonstrated acceptance/response steps
If unresolved	Investigate the mismatch; do not demand compliance with a drawing that has not been shown feasible.

Check your reasoning and transfer it

1. Load is 0-8; automatic 8-32; separate task 8-24; waiting 24-32; unload 32-38 seconds.

2. Manual work is 8 + 16 + 6 = 30 seconds, automatic duration 24, waiting 8 and elapsed sequence 38 seconds.

3. Operator-attendance requirements, prohibited access, unavailable work or unmeasured travel could change the arrangement.

Suggested completed record

Measure	Interval / calculation	Result
Manual	8 + 16 + 6	30 sec
Automatic	8-32	24 sec
Waiting	24-32	8 sec
Elapsed	0-38	38 sec

Plausible wrong turns

1. Automatic duration is not always additive labor.

2. A hypothetical overlap does not grant permission to enter a machine area.

Evidence of a sound answer

1. Use one time scale and preserve precedence.

2. Account for waiting without calling it manual work.

3. Name a concrete feasibility check.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process engineer with operator and equipment owner
Record	Resource combination table plus observed access, timing and quality conditions
Review	After a controlled timing trial and before standard revision
Verification evidence	Feasible precedence, complete work content and representative observed sequence timing
If unresolved	Retain the approved method; revise the model from actual evidence and reassess proposed overlap.

Check your reasoning and transfer it

1. 24,000 /320 =75 seconds per unit. The paper allocation is 75 / 75 / 60, with margins 0 / 0 / 15 seconds; equality to takt leaves no nominal allowance for variation.

2. Replacing the 10-second E4 with 12 seconds gives 75 / 77 / 60 and total 212 seconds. Operator 2 exceeds the new takt by 2 seconds.

3. The proposal is not demonstrated capable of meeting the changed demand. Investigate the E4 condition and authorized alternatives, then collect representative cycle and quality evidence. Do not delete checks or demand faster work to make the graph fit.

Suggested completed record

Calculation / decision	Worked result
New takt	75 sec/unit
Paper proposal	75 /75 /60; total 210 sec
Observed E4 variant	75 /77 /60; total 212 sec
Decision	Adapt and retest; no achieved capacity claim

Plausible wrong turns

1. Equal total work does not mean unchanged elapsed flow or safe access.

2. A below-takt average is not proof of sustainable output.

Evidence of a sound answer

1. Correctly preserve all ten elements in the proposal.

2. Calculate both changed cases with units and reconcile totals.

3. Identify at least one physical constraint and one verification measure.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Team leader and affected operators, supported by process engineering
Record	Element observation sheet, proposed assignment and trial decision
Review	Before changing the standard and after representative trial cycles
Verification evidence	Element timing/variation, safe access, precedence, quality and actual cycle behavior
If unresolved	Retain the authorized method, address the limiting condition and revise the trial; escalate systemic capacity gaps through daily management.

Check your reasoning and transfer it

1. Verified artwork is a candidate for external preparation; the stopped setup remains internal under the declared method.

2. The corrected sequence is prepare verified artwork, stop, approved setup, produce proof, obtain acceptance. Removing proof acceptance changes the completion criterion.

3. Observe before and trial runs using the same boundary and record adjustments, mix and proof outcome. No numerical reduction follows from the supplied information.

Suggested completed record

Work element	Decision	Status
Artwork	Prepare and verify externally if approved	Candidate
Setup	Retain approved stopped condition	Internal
Proof/acceptance	Retain both	Completion evidence
Savings	No times supplied	Do not quantify

Plausible wrong turns

1. External does not mean uncontrolled or unverified.

2. An improvement name is not evidence that a setup meets a particular time.

Evidence of a sound answer

1. Preserve the acceptance boundary.

2. Separate a preparation proposal from a validated change.

3. Name comparable observations needed.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Changeover process owner with quality and equipment representatives
Record	Element classification, readiness check and comparable timing/quality record
Review	At the controlled trial and before approving revised standard work
Verification evidence	Correct first output, unchanged necessary controls and measured elapsed performance
If unresolved	Retain the approved method and address readiness or technical constraints through their owners.

Check your reasoning and transfer it

1. Available now is 18 sachets, not 48. Six are damaged and 24 are not yet received.

2. The largest supplied observed interval consumption is 28, but two cycles do not establish a service guarantee or account for review frequency, variability and order constraints.

3. Verify physical versus recorded stock and signal/receipt timestamps; gather representative paired data and agree the service objective before approving a trial.

Suggested completed record

Status / observation	Quantity	Meaning
Usable	18	Available now
Damaged	6	Exclude from eligibility
Incoming	24	Not available until received
Observed consumption	10 and 28	Evidence, not approved stock target

Plausible wrong turns

1. A shelf limit is not a demand-based parameter.

2. The largest of a few observations is not automatically a statistically justified safety stock.

Evidence of a sound answer

1. Separate eligibility and on-order status.

2. Retain uncertainty rather than prescribing an unsupported number.

3. Connect sizing to service and replenishment controls.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Inventory and replenishment owner
Record	Stock-status reconciliation and signal-to-usable-receipt history
Review	Across representative cycles and at the agreed policy review
Verification evidence	Service outcome, stock accuracy, delay variation and excess/aged stock
If unresolved	Correct signal or receipt controls, obtain missing evidence and review parameters through the owner.

Check your reasoning and transfer it

1. Four new bags deliver 120 pieces, 20 more than the old 100-piece intent.

2. Review the pack basis, replenishment trigger, point-of-use capacity, handling data and any signal quantity dependent on the old pack.

3. Three bags deliver 90 and four deliver 120. Neither automatically preserves the intended 100; the owner must approve an appropriate supply rule and practical constraints.

Suggested completed record

Option / control	Calculation / evidence	Conclusion
Four bags	4 x 30	120 pieces; 20 extra
Three bags	3 x 30	90 pieces; 10 short
Decision	Review stock and supply intent	No silent rounding

Plausible wrong turns

1. A box or bag is not a stable quantity when packaging changes.

2. Correcting master data does not automatically correct the physical route.

Evidence of a sound answer

1. Keep packaging and piece units explicit.

2. Distinguish supplier shortage from approved change.

3. Trace the revised instruction to receipt.

Take the learning back to work

Commitment	Agreed follow-through
Owner	PFEP/master-data owner with purchasing and material-flow owner
Record	Controlled packaging change, dependent-field review and receipt trace
Review	At the packaging change and first representative replenishments
Verification evidence	Correct item/count/location and consistent approved handling instructions
If unresolved	Keep the discrepancy visible and use the approved interim supply response until all affected records and actions agree.

Check your reasoning and transfer it

1. The supplied boundary identifies four potentially affected units, P21-P24. Their suitability needs the approved review.

2. Use the named response/escalation owner; obtain process verification and product disposition under the actual criteria.

3. A display reset reports a control action, not proof of suitable labels or a corrected process.

Suggested completed record

Item	Evidence	Conclusion
Boundary	P20 accepted	Review starts after P20
Affected range	P21-P24	4 units potentially affected
Reset	No verification	No release inference
Restart	Criteria and authority needed	Record decision

Plausible wrong turns

1. An andon is not merely a colored performance display.

2. A reset is not a verified corrective action.

Evidence of a sound answer

1. Use a justified containment boundary.

2. Keep product and process decisions distinct.

3. Retain an authorized response and feedback loop.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Cell leader with authorized quality/equipment owners
Record	Abnormality, containment, verification, disposition and feedback record
Review	At response closure and the next recurrence review
Verification evidence	Criteria-based restart, controlled affected output and timely operator support
If unresolved	Escalate response capacity and unresolved conditions; retain the required controlled state.

Check your reasoning and transfer it

1. The fixture is a prevention/control candidate for proceeding without a washer, but the missing-washer and fault cases remain untested.

2. The camera detects absence as described; a warning alone does not establish blocked downstream escape.

3. A valid test record specifies expected behavior for present, absent and applicable fault conditions, using approved controlled test methods.

Suggested completed record

Control / evidence	Mechanism	Remaining requirement
Fixture	Prevent proceeding without washer	Challenge absence and fault
Camera	Detect and warn	Escape not proven blocked
Normal test	Present washer passed	Does not prove missing-part control

Plausible wrong turns

1. A warning is not automatically an interlock.

2. Testing only acceptable parts cannot prove protection against a specific error.

Evidence of a sound answer

1. Define the error and its escape boundary.

2. Separate intended design from validated behavior.

3. Include the fault response and maintenance/retest ownership.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process/design control owner with quality and operators
Record	Validated challenge matrix, response standard and change-trigger review
Review	At initial approval, defined challenge intervals and relevant changes
Verification evidence	Correct response to target error and credible faults without unsafe test practices
If unresolved	Retain containment and escalate failed controls; revise and revalidate the claim before relying on it.

Check your reasoning and transfer it

1. Missing acknowledgments are observed; sending, delivery and forgetting are not yet established.

2. Trace one synthetic notification end to end and observe the receiver acknowledgment step. Confirmed delivery with no acknowledgment points to a different transition than failed delivery.

3. A delivered message does not by itself prove forgetting: access, task clarity or competing workflow may explain the next gap. Continue from facts.

Suggested completed record

Claim / evidence	Interpretation / next step
No acknowledgment	Observed outcome
Delivery absent	Investigate notification transition
Delivery confirmed	Observe acknowledgment conditions
Preferred cause contradicted	Revise branch; do not blame

Plausible wrong turns

1. Exactly five answers do not validate a cause.

2. Retraining is not an evidence-backed countermeasure merely because the last box names a person.

Evidence of a sound answer

1. Label evidence status honestly.

2. Make competing predictions distinguishable.

3. State contrary evidence and a bounded next step.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process owner with people performing the affected handoffs
Record	Evidence-labelled cause/test record
Review	After each test and after the proposed response is trialed
Verification evidence	Reproducible mechanism, contrary evidence and recurrence/escape verification
If unresolved	Retain uncertainty, improve observation or use a more suitable analysis method.

Check your reasoning and transfer it

1. The first roll shortage starts with restoration and verification. Evidence of repeated shortages or a systemic replenishment failure would justify deeper gap investigation; a single event does not prohibit learning.

2. Five recurring Friday address errors require structured investigation beyond rework. The one-day dispatch aim is a target condition beyond the supplied two-day standard.

3. For the ambiguous complaint, establish the promise and actual timing before asserting the category. Make the customer response explicit while resolving that uncertainty.

Suggested completed record

Case	Initial learning route	Next evidence / response
Roll shortage	Restore	Review if recurrence or broader evidence emerges
Address errors	Gap-from-standard investigation	Owner tests causes using Friday/non-Friday comparison
One-day dispatch	Target-condition learning	Observe current work; define bounded trial
Unrecorded promise	Clarify reference	Obtain customer commitment and timing

Plausible wrong turns

1. Every problem does not require the same project template.

2. Restoration and recurrence prevention are not interchangeable completion criteria.

Evidence of a sound answer

1. Tie each route to a stated reference or unknown.

2. Keep immediate customer response visible.

3. Name contrary evidence that would change a classification.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Frontline lead and the owner of the affected process
Record	Brief problem-selection and handoff record linked to the live response
Review	At the next daily review and when new evidence changes the problem definition
Verification evidence	Clear current condition, standard/target, observed gap, tested versus unknown cause and assigned next learning step
If unresolved	Escalate an unclear standard or missing ownership; retain containment/restoration records without declaring recurrence solved.

Check your reasoning and transfer it

1. C is 5% and D is 5%; together 20 / 400 = 5%. C has more errors because it also has more cases in this sample.

2. Equal observed rates do not prove identical processes or future performance. Case mix, detection and variability remain relevant.

3. A defensible next step might separate request type and occurrence handoff, with errors and all cases counted consistently in each group.

Suggested completed record

Measure	Calculation / interpretation
C	12 / 240 = 5%
D	8 / 160 = 5%
Combined	20 / 400 = 5%
Conclusion	No worse-rate claim from raw counts

Plausible wrong turns

1. Do not average 2% and 10% to obtain the combined rate when volumes differ.

2. A stratum associated with an error is not automatically its cause.

Evidence of a sound answer

1. Use matching numerator/denominator definitions.

2. Reconcile totals and rates.

3. Choose a breakdown that answers a specific question.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process analyst and representatives who apply the event definition
Record	Stratified counts/rates with data definitions
Review	After collection and before causal analysis or prioritization
Verification evidence	Reconciled denominators, comparable scope and point-of-occurrence observations
If unresolved	Repair definitions or collect missing denominators rather than rank people from incomplete counts.

Check your reasoning and transfer it

1. Consulting a spreadsheet and missing skill data are facts; laziness or dislike of the queue are unsupported interpretations.

2. Ask how a receiver is selected and what information would be missing without the sheet. Check current authority and access with the owner.

3. Agree a controlled information route and revisit an assignment to verify accuracy, access and usability. Do not copy private data into the exercise or close on a promise.

Suggested completed record

Record field	Suggested reasoning
Observation	Spreadsheet used to identify available skill
Question	What assignment decision needs this information?
Support	Verify approved source, access and update owner
Return	Observe a correct assignment using approved information

Plausible wrong turns

1. Gemba is not a tour collecting blame.

2. Listening does not require accepting an unsafe or uncontrolled workaround.

Evidence of a sound answer

1. Separate fact from inference.

2. Ask a question that changes what is observed next.

3. Provide an owned support and verification loop.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process owner and visiting leader with the colleague doing the work
Record	Observation/support commitment linked to the actual handoff
Review	At the agreed return observation, then through daily follow-up if unresolved
Verification evidence	Accurate approved information available at the work and colleague feedback
If unresolved	Address the design/support barrier and retain current risk controls; do not blame the person who exposed the workaround.

Check your reasoning and transfer it

1. Ask what Mara expected a reminder to change and what the two requests show about the handoff. A larger reminder is a proposed solution, not evidence that the missing role agreement is resolved.

2. Mara can own a small test with an identified receiver. The leader owns convening the counterpart and securing the role agreement; review actual acknowledgments for the test requests.

3. If support is missing, mark the test not performed and escalate that barrier. Do not blame the owner for an untested method or move the due date without an accountable response.

Suggested completed record

Commitment	Responsible role / point	Action / verification
Owner	Mara	Test agreed handoff on a bounded request set
Leader support	Convene receiving supervisor	Confirm receiver and acknowledgment rule
Review	After agreed test window	Observe request identity and acknowledgment
Support absent	Trial not performed	Escalate; retain record and ownership

Plausible wrong turns

1. A completed walk does not establish effective leadership.

2. Coaching is not abandonment, and supporting the owner does not require taking over every solution.

Evidence of a sound answer

1. Use an evidence-seeking question rather than a disguised instruction.

2. Separate owner action from leader support.

3. Define observable verification and a credible overdue response.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Team leader and each named issue owner; next-level leader for cross-team barriers
Record	Leader routine plus commitment/evidence log
Review	At agreed daily verification points and weekly reflection on the routine
Verification evidence	Observed response, owner reasoning, supplied support and verified commitments
If unresolved	Escalate the specific barrier and adapt the routine; preserve honest status instead of measuring success by calendar completion.

Check your reasoning and transfer it

1. Initial gap is four. Two verified changes raise complete referrals to 13, leaving two: one acknowledgment and one information gap.

2. The receiving team must confirm the remaining acknowledgment; the information owner must supply and verify required details. Reminders are actions, not proof of completion.

3. Review actual records and carry unresolved items honestly into the next cycle.

Suggested completed record

Measure / item	Result / next evidence
Revised actual	11 + 2 = 13
Remaining gap	15 - 13 = 2
Acknowledgment	One remains; receiver confirmation
Information	One remains; verified missing detail

Plausible wrong turns

1. Escalated is not resolved.

2. A changing total is not useful if blocked identities disappear.

Evidence of a sound answer

1. Reconcile counts without premature green status.

2. Name receiving authority and evidence.

3. Close the board-to-work-to-board loop.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Frontline lead with receiving support owners
Record	Plan/actual gap board and linked action records
Review	At agreed intraday checks and next daily huddle
Verification evidence	Observed condition change, accepted escalation and correct remaining scope
If unresolved	Escalate missing authority/response and assign deeper investigation for recurring gaps.

Check your reasoning and transfer it

1. The shared specialist cannot simply be promised twice; observe demand and agree priorities or an alternative sequence with the responsible authority.

2. A bounded cohort trial can test a coordinated schedule while recording displaced support work. The exact schedule is not given, so several feasible proposals are valid.

3. Measure time to complete setup, unresolved access/training needs and effect on support demand. A faster first appointment alone is insufficient.

Suggested completed record

Agreement field	Suggested entry
Conflict	Same specialist, same time; existing work unaccounted
Trial	Bounded cohort with coordinated appointments
Authority	Sponsor agrees priority/capacity tradeoff
Review	Complete onboarding time, defects and displaced work

Plausible wrong turns

1. Catchball is not consensus theatre or simple target cascading.

2. Departmental commitment does not create resource capacity.

Evidence of a sound answer

1. Make a concrete means/capacity assumption visible.

2. Resolve both vertical and horizontal responsibilities.

3. Include a measure that can challenge the proposed success.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Strategy sponsor and cross-functional contribution owners
Record	Contribution/trial agreement linked to strategic purpose
Review	At the agreed trial review and periodic strategic reflection
Verification evidence	Customer outcome, operational feasibility, capacity tradeoffs and unintended effects
If unresolved	Return the constraint to the sponsor and revise means or commitments rather than quietly accepting impossible targets.

Check your reasoning and transfer it

1. The prediction missed by two cases: six, not eight, had usable dates. The checklist did not create missing customer information.

2. A next test could trial an agreed clarification request and receiving responsibility for the two missing-date conditions, with a prediction about obtaining or explicitly resolving the date before handoff.

3. Do not claim a permanent improvement from one eight-case trial or treat blank fields as usable dates to meet the count.

Suggested completed record

Record field	Suggested entry
Prediction / actual	8 of 8 versus 6 of 8
Learning	Customer information is still missing
Next test	Bounded clarification/ownership process
Unproven	Long-term success and broader applicability

Plausible wrong turns

1. The coach should not supply a preferred solution disguised as a question.

2. A failed prediction can be useful learning, not a reason to rewrite the record.

Evidence of a sound answer

1. Keep prediction and actual separate.

2. Connect the next test to a learned obstacle.

3. Specify scope, evidence and a review point.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Improvement learner with an identified coach and process owner
Record	Current/target condition and experiment learning record
Review	At the agreed next observation after each bounded test
Verification evidence	Prediction, actual, inclusion conditions and resulting knowledge
If unresolved	Revisit the obstacle or observation method; keep the target and local authority visible while adapting the next test.

Check your reasoning and transfer it

1. A suitable breakdown retrieves the controlled source, checks task identity/status/revision and confirms the instruction is usable for the assigned task. The reason is avoiding an obsolete or wrong instruction.

2. The learner should identify the authority and explain the check, including the missing-copy response. A different file arrangement tests whether the reason transfers.

3. If selection depends only on position, reteach the key point and observe a changed layout; do not accept a lucky correct selection as sufficient.

Suggested completed record

Important step	Key point	Reason
Retrieve	Use controlled source	Avoid obsolete downloads
Check	Task identity, current status/revision	Confirm applicable instruction
Respond	Escalate missing current copy	Do not improvise from old version

Plausible wrong turns

1. A job breakdown is not an exhaustive transcript of every motion.

2. Attendance or a single lucky selection is not demonstrated competence.

Evidence of a sound answer

1. Connect every important key point to a reason.

2. Observe the learner, not only the instructor.

3. Define follow-up for a changed but representative case.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Qualified instructor with task/process owner
Record	Approved job breakdown and demonstrated-skill follow-up
Review	During try-out and subsequent representative task observations
Verification evidence	Correct performance, explained key points/reasons and appropriate help seeking
If unresolved	Revisit the specific teaching gap or escalate an unclear method; retain support until competence is demonstrated.

Check your reasoning and transfer it

1. The morning record shows one acceptable moment; later evidence shows the status routine did not reliably maintain the reference.

2. Use the approved status/hold response and assign the tool-status owner; do not assume ready from shelf location.

3. Verify identity/status at representative handovers and check that return/hold roles work across shifts. Record failures honestly; one later pass does not prove permanence.

Suggested completed record

History / decision	Suggested entry
Morning	Reference met at that observation
Later	Unknown-status tool in ready stock
Response	Control status under approved route; owner assigned
Sustain check	Observe subsequent handovers and role use

Plausible wrong turns

1. Shine does not mean making a floor look glossy at the expense of usable condition.

2. Sustain is not proven by a single after-photo or a high audit score.

Evidence of a sound answer

1. Use time and comparable conditions.

2. Preserve recurrence evidence.

3. Connect response to a specific routine and owner.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Area owner with representatives from every relevant shift
Record	Dated condition history, finding response and approved reference
Review	At handovers and agreed recurring condition reviews
Verification evidence	Comparable observations, actual response use and recurring-finding status
If unresolved	Keep findings open, adjust support/standard through its owner and route equipment mechanisms to qualified investigation.

Check your reasoning and transfer it

1. Record U7, the window, NC-U7, recurring internal smear and the two external cleans. Source remains unknown; do not call it a particular failed component.

2. Do not turn an external-care instruction into authority to open the enclosure. Route technical access and assessment to the qualified role under its procedure while the leader manages the local response.

3. Closure needs the agreed technical and condition evidence, not a clean exterior. Recurrence under comparable conditions keeps the issue active and informs the care routine or maintenance plan.

Suggested completed record

Record field	Suggested entry
Observation	Recurring internal smear after two external cleans
Immediate decision	Stay within approved external-care scope
Handoff	Qualified technical owner accepts assessment
Verification	Comparable condition; record recurrence or verified normal
Feedback	Update authorized standard only after reviewed learning

Plausible wrong turns

1. Autonomous maintenance is not unrestricted repair.

2. A cleaning record is not evidence that a source of deterioration was corrected.

Evidence of a sound answer

1. Separate observation from diagnosis and cleaning from closure.

2. Name a receiving role and review point.

3. Make verification-to-care feedback explicit.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Asset owner with operator, team leader and maintenance
Record	Abnormality ticket linked to normal-condition reference and work order
Review	At the agreed handover/verification point and daily while unresolved
Verification evidence	Accepted ownership, authorized action, comparable condition observations and recurrence status
If unresolved	Keep the condition visible, reassess local controls and escalate technical support; feed recurrence into planned maintenance or structured investigation.

Check your reasoning and transfer it

1. Missing measurements and a return test leave execution evidence unresolved; the interval cannot be diagnosed from the tick and alarms alone.

2. Retrieve records, compare alarm conditions and ask the qualified owner to evaluate task suitability. A justified plan names the technical work and required acceptance evidence without inventing a repair.

3. Immediate function verification supports return under defined conditions; later representative exposure tests recurrence and plan effectiveness.

Suggested completed record

Question	Evidence / decision
Execution	Obtain condition and return records
Suitability	Connect task to supported mechanism
Interval	Review only with justified failure/condition evidence
Effectiveness	Track comparable later operation and recurrence

Plausible wrong turns

1. More frequent maintenance is not automatically more effective maintenance.

2. A completion percentage is not a reliability result.

Evidence of a sound answer

1. Distinguish the competing explanations.

2. Keep technical authority and prerequisites explicit.

3. Require separate return and later-effectiveness evidence.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Maintenance technical owner and planner with the asset owner
Record	Failure history, task review, authorized work package and effectiveness record
Review	Before plan changes, at return acceptance and after representative exposure
Verification evidence	Failure mechanism, execution detail, restored function and recurrence behavior
If unresolved	Continue technical investigation and adjust the approved maintenance strategy; retain honest unresolved status.

Check your reasoning and transfer it

1. Availability is 400 / 480 = 83.33%; performance is 800 x 0.4 / 400 = 80%; quality is 750 / 800 = 93.75%. OEE is 62.5%, also 300 good ideal minutes /480.

2. Availability loss is 80 minutes; performance loss is 400 minus 320 = 80 minutes; quality ideal loss is 320 minus 300 = 20 minutes. These plus 300 good ideal minutes total 480.

3. The 20 later recovered units do not change 750 first-pass good. The loss categories suggest questions, not a diagnosis or proof of customer throughput improvement.

Suggested completed record

Measure	Worked result
Availability / performance / quality	83.33% / 80% / 93.75%
OEE	62.5%; 300 / 480
Losses	80 + 80 + 20 = 180 min
Reconcile	180 + 300 = 480 min
Recovery	20 separate; first-pass good remains 750

Plausible wrong turns

1. Do not add the three percentage factors or average them.

2. Equivalent quality-loss minutes are not necessarily actual rework clock minutes.

Evidence of a sound answer

1. Reconcile both OEE calculation paths.

2. Preserve first-pass definition and units.

3. Choose a specific event-data question rather than asserting a cause from the percentage.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Performance-data owner with production, quality and maintenance
Record	Controlled shift loss record linked to time and unit events
Review	At loss review and after a targeted countermeasure trial
Verification evidence	Consistent definitions, reconciled counts/time and observed loss mechanisms
If unresolved	Repair data scope or investigate event records before changing targets or attributing causes.

Check your reasoning and transfer it

1. The hypothesis must explain how the guide condition could influence the seal; visible residue alone does not prove that link.

2. Condition restoration can be accepted on its own evidence while the quality issue remains unresolved because output still fails. Apply actual product response controls.

3. Review job/material identity, process conditions and suitable product measurements to test alternatives, including material variation. Do not restore the dirty condition merely to reproduce a defect outside an authorized test.

Suggested completed record

Decision	Evidence / next step
Condition	Guide passes approved reference
Product	Test package fails; quality issue open
Mechanism	Incomplete or insufficient explanation
Next evidence	Material/process/measurement comparison under approved plan

Plausible wrong turns

1. A clean asset is not proof of conforming output.

2. Two conditions appearing together do not establish a causal mechanism.

Evidence of a sound answer

1. Link a specific product characteristic to a testable mechanism.

2. Separate technical condition acceptance from quality closure.

3. Retain an alternative and define the next controlled observation.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Quality/process engineer with maintenance and operations
Record	Condition-quality mechanism record, approved checks and dual verification
Review	After authorized response and across relevant operating conditions
Verification evidence	Supported mechanism, controlled condition, acceptable output and recurrence history
If unresolved	Maintain applicable product/operating controls and investigate alternatives; revise the maintained condition only through technical review.

Check your reasoning and transfer it

1. Technical review at 32 is initially lowest against demand 45, a modeled gap of 13 per day.

2. After review reaches 46, approval at 40 is lowest, leaving a gap of 5 per day.

3. Align readiness and release with the current approval limitation and investigate its losses. More technical-review capacity alone does not remove the 40-per-day model limit.

Suggested completed record

Condition	Comparison	Decision
Before	32 versus demand 45	Review; gap 13/day
After	40 versus demand 45	Approval; gap 5/day
Next step	Return to identification	Revise support rules

Plausible wrong turns

1. Elevation is not required when earlier improvement breaks the constraint.

2. The slowest resource is not necessarily binding when demand is lower.

Evidence of a sound answer

1. Use the same period and mix.

2. Re-identify after changed evidence.

3. Distinguish system delivery from local utilization.

Take the learning back to work

Commitment	Agreed follow-through
Owner	System owner with current constraint and supporting-process leaders
Record	Constraint hypothesis, focusing decisions and system-output observations
Review	After each material improvement and at the ongoing system review
Verification evidence	Reliable accepted delivery, current constraint evidence and aligned support decisions
If unresolved	Reopen the boundary or hypothesis; do not preserve obsolete rules because the previous project was successful.

Check your reasoning and transfer it

1. At demand 12, all supplied capacities exceed demand. Y is slowest but not a binding internal capacity limit against that demand.

2. At demand 18, Y at 15 becomes the first internal hypothesis, with a modeled gap of three units per hour.

3. Check actual mix, readiness, starvation, blocking, quality and policy effects; a capacity purchase requires evidence of the remaining limitation.

Suggested completed record

Scenario	Comparison	Conclusion
Demand 12	Y 15 exceeds 12	No modeled internal shortfall
Demand 18	Y 15 below 18	Hypothesis Y; gap 3/hour
Investment	Mechanism unknown	Observe before committing

Plausible wrong turns

1. The biggest queue is not conclusive constraint evidence.

2. The slowest stage need not limit sales when demand is lower.

Evidence of a sound answer

1. Use demand in the comparison.

2. Retain assumptions and unknown causes.

3. Choose observations capable of changing the hypothesis.

Take the learning back to work

Commitment	Agreed follow-through
Owner	System owner with process and planning representatives
Record	Demand/capacity comparison and time-stamped state observations
Review	After representative observation and every material demand/mix/process change
Verification evidence	An explanatory hypothesis consistent with accepted delivery and loss states
If unresolved	Revisit the boundary, data comparability or policy mechanism before adding capacity.

Check your reasoning and transfer it

1. K11 release is 11:20 and nominal ready time 12:00. K12 release is 12:00 and nominal ready time 12:40. Each initially has 60 minutes protective allowance.

2. Starting K11 at 11:50 with 40 minutes preparation predicts 12:30 readiness, leaving 30 minutes to 13:00. The 30-minute late start consumes half the original 60-minute allowance.

3. A later 13:10 ready estimate predicts a 10-minute miss. Escalate the actual blocker and seek an authorized recovery/schedule decision; record whether the forecast or outcome changes.

Suggested completed record

Job / condition	Time calculation	Protection / response
K11 planned	11:20 release	12:00 nominal ready; 60 min protection
K12 planned	12:00 release	12:40 nominal ready; 60 min protection
K11 starts 11:50	12:30 nominal ready	30 min remaining
K11 estimate 13:10	10 min after drum	Escalate blocker; schedule owner decides

Plausible wrong turns

1. The rope is information controlling release, not the material path.

2. Protective lead is not permission for unlimited WIP or a promise of achieved throughput.

Evidence of a sound answer

1. Use the stated total lead once, without double counting.

2. Calculate remaining protection and predicted lateness separately.

3. Name a job-specific response and retain quality readiness.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Constraint schedule owner with upstream and material-flow leaders
Record	Job release/readiness log linked to the drum schedule
Review	At release/readiness checks and after representative operating cycles
Verification evidence	Actual release/arrival, readiness, starvation, missed commitments and excess WIP
If unresolved	Reassess blocker, protective lead and constraint assumptions; approve schedule/rule changes deliberately rather than bypassing release discipline.

Check your reasoning and transfer it

1. K2 is the highest-status eligible job and should be selected under the stated policy. K1 requires material acceptance response; its status does not authorize use of unaccepted material.

2. Three of four listed episodes involve material, making that dependency a reasonable investigation focus. Determine why readiness failed.

3. No buffer-consumption percentages, universal red thresholds or optimal buffer sizes can be calculated from these inputs.

Suggested completed record

Action	Evidence	Decision
Dispatch	K2	High and eligible
Escalate	K1	Material acceptance owner
Investigate	3 of 4 material episodes	Dependency, not proven root cause
Calculate	No numeric buffer data	Do not invent thresholds

Plausible wrong turns

1. High priority does not create eligibility.

2. Repeated red status does not automatically prove the buffer should be enlarged.

Evidence of a sound answer

1. Apply the supplied policy consistently.

2. Keep recovery and recurring-cause inquiry distinct.

3. Respect unavailable numerical information.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Planning/system owner with readiness and execution counterparts
Record	Status/readiness history, dispatch exceptions and recurring-cause log
Review	During execution and at the agreed buffer-policy review
Verification evidence	Reliable commitments, timely blocked-work response and reduced recurring readiness failures
If unresolved	Review release, reliability and protection assumptions explicitly; do not hide the signal through unexamined parameter changes.

Check your reasoning and transfer it

1. C contributes 70 per sale and 5 per constraint-minute. D contributes 60 and 10 per constraint-minute.

2. Six C consume 84 minutes, leaving 36; six D fit. This meets the C minimum and stays below the D cap.

3. The mix uses 120 minutes and contributes 6 x 70 + 6 x 60 = 780 monetary units before operating expense. Eight D would use 48 minutes and leave only 72, enough for five C, violating the six-C minimum.

Suggested completed record

Allocation	Constraint use	Contribution / conclusion
C	6 x 14 = 84 min	6 x 70 = 420
D	6 x 6 = 36 min	6 x 60 = 360
Feasible total	120 min	780 before operating expense
Eight-D-first	Only 5 C fit	Minimum commitment violated

Plausible wrong turns

1. Highest rate does not override sold-demand limits or commitments.

2. Contribution before operating expense is not net profit.

Evidence of a sound answer

1. Use the correct scarce-time denominator.

2. Reconcile integer units, time and commitments.

3. State the incomplete scope of the financial conclusion.

Take the learning back to work

Commitment	Agreed follow-through
Owner	System/planning owner with finance and commercial authority
Record	Decision assumptions, feasible mix comparison and observed sold outcome
Review	Before committing a real mix and after material demand/capacity/cost changes
Verification evidence	Accepted sales, relevant expense effects and constraint/commitment compliance
If unresolved	Rebuild the comparison when constraints or assumptions change; obtain the missing decision data.

Check your reasoning and transfer it

1. C-before-D is the supplied resource order; both remain logically available after project readiness. E can proceed on its separate resource under its own conditions.

2. Final review must wait for all three outputs. Feeder protection concerns E's join; project protection concerns the accepted project commitment.

3. Durations, calendars, resource commitments and uncertainty/sizing policy are missing. A numerical critical chain or promise would be invented.

Suggested completed record

Network element	Meaning	Decision
C > D	Resource order	One technician
C/D/E > review	Output dependencies	All three required
E feeder	Separate analyst	Protect its joining condition
Numeric schedule	Inputs missing	No calculated date or size

Plausible wrong turns

1. A resource link is not always a technical prerequisite.

2. A named buffer is not a justified duration.

Evidence of a sound answer

1. Keep the independent feeder visible.

2. Avoid double-booking the specialist.

3. State the missing scheduling evidence.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Project owner with planner and resource owners
Record	Resource-feasible network, estimate basis and explicit protection policy
Review	At planning approval and meaningful scope/resource changes, then during execution
Verification evidence	Feasible assignments, ready handoffs and accepted project delivery against the approved basis
If unresolved	Replan through the project owner; address recurring readiness or resource conflicts rather than hiding task padding.

Check your reasoning and transfer it

1. The shared objective is correct, timely customer commitments. Efficient use of expertise and timely response are needs; weekly batching and daily reviewing are proposed actions.

2. One testable assumption is that daily review necessarily wastes more specialist time. Ready-case preparation and a protected slot might alter that relationship.

3. Measure specialist review/preparation burden, decision timeliness and correctness. Check interruptions, incomplete cases and shifted workload; do not declare success from daily meetings alone.

Suggested completed record

Cloud / test element	Statement	Evidence to collect
Need A	Responsible use of expertise	Review/preparation burden
Need B	Timely correct response	Decision timeliness and quality
Assumption	Daily review necessarily inefficient	Test with ready cases
Unwanted effect	Preparation shifted elsewhere	Observe workload and rework

Plausible wrong turns

1. A conflict cloud is not a voting device or proof of causation.

2. A compromise action is not automatically an injection that meets both needs.

Evidence of a sound answer

1. Represent both parties fairly.

2. Test an explicit assumption.

3. Require evidence for both needs and unwanted consequences.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Both decision owners with a neutral facilitator
Record	Agreed cloud, assumption evidence and bounded injection test
Review	At trial agreement and after evidence from the defined test period
Verification evidence	Both legitimate needs met with necessary conditions and unwanted effects examined
If unresolved	Revise the assumptions or injection jointly; do not report a plausible diagram as a validated resolution.

Check your reasoning and transfer it

1. Validation at 12 is the first internal hypothesis against demand 15, a modeled gap of three cases per day.

2. Lean inquiry follows missing documents, waiting and rework with the people doing the work. TOC inquiry asks how the dependency limits useful validation capacity and how intake/support should align.

3. Test proposal B without claiming it is proven: record readiness, validation completions, correct authorized cases, total waiting and workload. If missing documents are rare or the check merely moves a longer queue upstream, revise the mechanism and trial.

Suggested completed record

Decision element	Evidence / action	Interpretation
Hypothesis	Validation 12 versus demand 15	Gap 3/day
Trial	Complete-document readiness + response	Observe rather than assume
System check	Correct authorized cases and waiting	Customer outcome
Disconfirming evidence	Longer total queue or no interruption effect	Adapt/stop

Plausible wrong turns

1. Combining method questions does not merge their control rules.

2. Constraint focus does not justify ignoring safety, quality or people elsewhere.

Evidence of a sound answer

1. Connect the proposed action to a system mechanism.

2. Retain one clear release authority.

3. Specify evidence that can disconfirm the preferred intervention.

Take the learning back to work

Commitment	Agreed follow-through
Owner	System improvement owner with affected operators and process owners
Record	Problem evidence, trial/release rule and whole-system result review
Review	After a bounded representative trial and any changed constraint evidence
Verification evidence	Correct delivery, controlled WIP, reduced relevant interruptions and sustainable work
If unresolved	Revisit the mechanism or constraint hypothesis; preserve necessary controls and avoid multiplying incompatible release rules.

Check your reasoning and transfer it

1. Use a histogram for distribution while retaining order elsewhere, a Pareto of summed delay minutes for the burden, and a hypothesis/test record informed by a fishbone for explanations.

2. A histogram does not establish stability; a time Pareto does not prove cause; a fishbone does not verify a branch. A rare long delay can contribute more minutes than many short delays.

Suggested completed record

Request	Defensible selection	Required boundary
Distribution	Histogram of delay minutes	No stability claim
Time burden	Pareto of minutes by category	One comparable basis
Explanation	Competing hypotheses and tests	Zero causes verified initially

Plausible wrong turns

1. The familiar 80/20 phrase is not a result to impose on the data.

2. Tool names do not replace an operational definition.

Evidence of a sound answer

1. Match each question to a suitable view.

2. Preserve time/pair/source information needed for later analysis.

3. Separate prioritization from causal proof.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process analyst with the record owner
Record	Question, collection definition, selected display and interpretation note
Review	At the next evidence review
Verification evidence	A colleague can reproduce the display and distinguish findings from hypotheses
If unresolved	Return to data definition or collection when the requested conclusion exceeds the evidence.

Check your reasoning and transfer it

1. Four distinct affected units out of 40 gives 10%. Six nonconformities out of 40 gives 0.15 per inspected unit.

2. Scratches, burrs and missing labels each occur twice. Their sum is six. An uninspected cover must not silently enter the inspected denominator; either inspect it under the defined scope or report the actual inspection amount.

Suggested completed record

Measure	Numerator / denominator	Result
Nonconforming units	4 / 40	10%
Nonconformities per unit	6 / 40	0.15
Category totals	2 + 2 + 2	6

Plausible wrong turns

1. 0.15 faults per unit is not 15% nonconforming units.

2. Counting only problem units loses the inspected denominator.

Evidence of a sound answer

1. Reconcile both counts independently.

2. Retain multiple faults on a unit.

3. Make ambiguous inspection scope visible.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Inspection process owner
Record	Released collection form and reconciled summary
Review	After the pilot and at the next scheduled data review
Verification evidence	Different reviewers reproduce the counts from the same original records
If unresolved	Correct definitions, training or record capture before comparing rates across windows.

Check your reasoning and transfer it

1. Forty events sort as burr 18, scratch 12, missing label 6, other 4. Cumulative percentages are 45%, 75%, 90% and 100%.

2. Recovery minutes are scratch 24, burr 90, missing label 60 and other 120, total 294. "Other" is the largest time burden despite the lowest frequency. A team may investigate burr frequency and separately examine the high-time "other" work.

Suggested completed record

Frequency rank	Count	Cumulative percentage
Burr	18	45%
Scratch	12	75%
Missing label	6	90%
Other	4	100%

Plausible wrong turns

1. The first two categories need not equal 80%.

2. A category priority is not a verified cause or an instruction to ignore severity.

Evidence of a sound answer

1. Reconcile 40 events and 294 minutes separately.

2. Explain why the two priority lists differ.

3. Retain the illustrative-duration assumption.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Quality analyst and improvement sponsor
Record	Ranked source-linked chart plus bounded investigation decision
Review	At each comparable reporting window
Verification evidence	Same basis, complete categories and actual investigation evidence
If unresolved	Revisit collection definitions or choose a different basis when the decision question changes.

Check your reasoning and transfer it

1. Counts are 1,2,2,3, totaling 8. The value 10.10 enters the fourth bin at its included lower edge;10.20 is included by the final-endpoint exception.

2. The same eight values could appear in rising order or alternate high/low. Those sequences have identical bin counts but different time behavior, so retain the original order and context.

Suggested completed record

Bin	Assigned values	Count
First	9.80	1
Second	9.90,9.95	2
Third	10.00,10.05	2
Fourth	10.10,10.15,10.20	3

Plausible wrong turns

1. A histogram does not keep time order.

2. A visually symmetric sample does not prove normality or stability.

Evidence of a sound answer

1. Place all 8 values once.

2. State endpoint convention explicitly.

3. Separate distribution description from a stability conclusion.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Measurement-data owner
Record	Raw ordered values, bin rule and source-linked histogram
Review	At the next distribution review or any bin-rule change
Verification evidence	Reconciled counts and retained time/source identity
If unresolved	Correct collection or binning before comparing shapes; investigate ordering with an appropriate separate view.

Check your reasoning and transfer it

1. The correct points remain(1,6),(2,4),(3,7),(4,5); they do not show a steady increase. Sorting the response column independently invented different observations.

2. Record time/order or source identity and design an authorized comparison that separates setting from that influence. No causal conclusion follows from correcting the graph alone.

Suggested completed record

Setting	Correct response	Sorted-column error
1	6	Would wrongly become 4
2	4	Would wrongly become 5
3	7	Would wrongly become 6
4	5	Would wrongly become 7

Plausible wrong turns

1. Association does not prove cause.

2. A fitted line cannot repair broken observation pairing.

Evidence of a sound answer

1. Retain all four exact pairs.

2. Identify the fabricated relationship.

3. State a testable rival explanation and authorized next evidence.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process analyst with an authorized experiment owner
Record	Paired source record, inference note and approved comparison plan
Review	Before any trial and after each reviewed result
Verification evidence	Pair integrity, controlled context and evidence that discriminates between explanations
If unresolved	Collect missing context or redesign the study rather than treating correlation as a command.

Check your reasoning and transfer it

1. C is 10%; D is 5%. The pooled fraction is 11/190=5.789%, approximately 5.79%. The unweighted average 7.5% gives the small and large groups equal influence.

2. Request product, sampling and measurement context and collect comparable evidence. The observed difference is not proof that C causes more defects or needs a specific intervention.

Suggested completed record

Group	Calculation	Result
C	3/30	10%
D	8/160	5%
Pooled	11/190	5.79%

Plausible wrong turns

1. A small count is not necessarily a small rate.

2. A source difference is not automatically a cause.

Evidence of a sound answer

1. Use actual denominators.

2. Distinguish pooled and average-of-rate questions.

3. Name a concrete missing comparator.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Quality data owner with process leaders
Record	Source-stratified comparison and collection plan
Review	At the next comparable observation window
Verification evidence	Consistent classifications, denominators and product context
If unresolved	Improve source capture or sampling before assigning a cause-specific action.

Check your reasoning and transfer it

1. An empty reel could explain label absence; missed detection could explain escape. Either or both may be relevant, but neither is verified by this record.

2. Match carton timing to reel status and inspect the authorized application record. Separately use the approved detection challenge procedure with controlled test pieces; define what a successful or failed challenge would show without releasing test pieces as product.

Suggested completed record

Branch	Question	State
Occurrence	Was label supply/application absent at the affected time?	Unverified
Escape	Could the approved detection check find the missing condition?	Unverified
Total verified causes	No completed discriminating evidence	0

Plausible wrong turns

1. An escape cause is not necessarily the occurrence cause.

2. A fishbone vote is not verification.

Evidence of a sound answer

1. Keep facts separate from hypotheses.

2. Predict a contrary outcome.

3. Avoid inventing a completed test.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Investigation owner with process and measurement specialists
Record	Hypothesis, prediction, test result and decision log
Review	After each completed comparison
Verification evidence	Traceable observations and a bounded inference, including contrary evidence
If unresolved	Revise the test or investigate another branch; do not rename an inconclusive result as proof.

Check your reasoning and transfer it

1. I-MR is a candidate for individual duration, subject to distribution/dependence and measurement review. The six mixed-machine readings are not automatically a rational subgroup; preserve source identity and design the grouping first.

2. Use u as a candidate for multiple faults per varying cable length, and np for nonconforming-unit count at fixed 50. A p display of the same fixed-size unit fractions is also defensible if its scale is clear.

Suggested completed record

Record	Candidate or action	Boundary
Duration	I-MR candidate	Assess dependence and distribution
Mixed measurements	Repair subgroup design	Do not pool unlike conditions casually
Cable faults	u candidate	Known comparable opportunity per length
Fixed 50 pass/fail	np or clearly labelled p	One classification per unit

Plausible wrong turns

1. A tool choice is not a stability finding.

2. A u rate counts multiple faults; a p fraction classifies units.

Evidence of a sound answer

1. Keep unit and event counts distinct.

2. Identify the invalid mixed subgroup.

3. Accept justified alternatives with explicit assumptions.

Take the learning back to work

Commitment	Agreed follow-through
Owner	SPC owner and process measurement lead
Record	Chart-selection, sampling and response-plan record
Review	Before baseline collection and after process/sampling changes
Verification evidence	A defined observation, defensible model and reviewed reaction plan
If unresolved	Redesign sampling or seek a suitable specialist method instead of forcing a familiar chart.

Check your reasoning and transfer it

1. Observations 1 and 4 meet specifications and do not cross a control limit. Observation 2 exceeds USL 20.10 by 0.05 mm but remains inside UCL 20.20. Observation 3 exceeds both USL and UCL.

2. Both 2 and 3 need product disposition under the applicable plan. Observation 3 additionally supplies the illustrated process signal; observation 2 alone does not.

3. The four points cannot establish stability, capability or the complete containment boundary. Other pattern rules and process context may alter the broader response.

Suggested completed record

Observation / mm	Specification status	Beyond-limit decision
1:20.05	In specification	No beyond-limit signal
2:20.15	Nonconforming	No beyond-limit signal
3:20.25	Nonconforming	Beyond UCL; process investigation
4:19.95	In specification	No beyond-limit signal

Plausible wrong turns

1. Passing the drawing does not cancel a process signal.

2. Control limits are not customer tolerances and must not be moved merely to remove an alarm.

Evidence of a sound answer

1. Give both classifications for every observation.

2. Separate product disposition from process investigation.

3. State the baseline assumption and a limit on the inference.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process owner with quality engineering
Record	Chart event and product-disposition references
Review	At the signal response and subsequent approved verification
Verification evidence	Correct chart identity, baseline, measurement context, affected-output assessment and disposition authority
If unresolved	Retain the signal/hold records and escalate the uncertainty; obtain suitable evidence before revising limits or declaring performance.

Check your reasoning and transfer it

1. Mean limits are 30 ± .577x.40=29.7692 and 30.2308 mm. Range limits are 0 and 2.115x.40=.846 mm.

2. Range .70 is within the displayed range limits; mean 30.30 exceeds 30.2308 and signals under the stated point rule. Product release still requires the actual specification and applicable decision process.

Suggested completed record

Chart	Limits	Later point
R	0 to .846 mm	.70: within
Xbar	29.7692 to 30.2308 mm	30.30: above UCL

Plausible wrong turns

1. Control limits are not product limits.

2. The six original illustration points do not estimate the supplied historical baseline.

Evidence of a sound answer

1. Use constants for n=5.

2. Identify the mean signal after checking spread.

3. Avoid automatic release or limit recalculation.

Take the learning back to work

Commitment	Agreed follow-through
Owner	SPC owner with station quality lead
Record	Baseline revision, subgroup record and signal investigation
Review	At each defined subgroup and after reviewed process changes
Verification evidence	Traceable data and verified response with unchanged justified limits
If unresolved	Investigate measurement/process conditions; revise the baseline only through the authorized evidence review.

Check your reasoning and transfer it

1. Sigma=.0564/1.128=.05 mm; individuals limits 4.85-5.15 mm. MR upper limit 3.267x.0564=.1842588 mm.

2. Adjacent ranges are .04,.06,.22 mm. The final 5.20 reading exceeds 5.15; its .22 moving range exceeds .1842588. Sorting would change the batch neighbors and their differences.

Suggested completed record

Statistic	Values or limits	Signal
Individuals	4.85-5.15 mm	5.20 above UCL
Moving range	.04,.06,.22 mm; UCL .1842588	.22 above UCL

Plausible wrong turns

1. Moving ranges must remain adjacent in original order.

2. A control signal does not specify a safe adjustment.

Evidence of a sound answer

1. Use the supplied historical baseline.

2. Align ranges to their pairs.

3. Record both signals without inventing cause.

Take the learning back to work

Commitment	Agreed follow-through
Owner	SPC analyst and batch-process owner
Record	Ordered measurements, baseline revision and pair-linked response log
Review	At each defined observation and during baseline review
Verification evidence	Correct pair alignment, measurement fitness and verified response
If unresolved	Investigate dependence or process changes; do not conceal signals through sorting or automatic rebaselining.

Check your reasoning and transfer it

1. 36/200=.18. For n200, the supplied-baseline limits are approximately .03636-.16364; .18 exceeds the upper limit.

2. Report an upward signal and follow the approved response. Dividing by 100 invents a denominator; the chart itself does not decide the disposition of particular units.

Suggested completed record

Calculation	Result	Decision
36/200	.18	18% observed
Upper limit	.16364	.18 is above UCL
Product status	Separate applicable criteria	No automatic release or scrap

Plausible wrong turns

1. A point within limits can still represent an unacceptable defect level.

2. Multiple faults on one item do not create multiple affected units.

Evidence of a sound answer

1. Use n200 consistently.

2. Distinguish fraction and count scales.

3. Preserve signal and response authority.

Take the learning back to work

Commitment	Agreed follow-through
Owner	SPC and inspection owners
Record	Count, denominator, baseline and sample-specific response record
Review	At each sampling interval and whenever sampling changes
Verification evidence	One classification per unit, correct n and verified response
If unresolved	Resolve denominator/model changes before applying a fixed-n interpretation.

Check your reasoning and transfer it

1. The u rate is 68/80=.85 per m², above its .73717 upper limit. The c count 20 is above 18 at the defined fixed exposure.

2. Both signal under the stated point rule, but their centers and exposure definitions belong to separate fictional processes. Neither result identifies a cause or product disposition.

Suggested completed record

Process	Observation	Comparison
u	.85 per m²	Above .73717
c	20 counts	Above 18

Plausible wrong turns

1. Fault rate is not the fraction of affected sheets.

2. Dividing by area does not automatically guarantee comparable opportunity.

Evidence of a sound answer

1. Keep count and exposure together.

2. Use the correct process baseline.

3. Name model and response limitations.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Inspection-method and SPC owners
Record	Event/exposure record, model rationale and reaction log
Review	At each observation and after surface or inspection changes
Verification evidence	Comparable opportunity, traceable counts and appropriate response
If unresolved	Revisit sampling or model choice if clustering, exposure or classification changes invalidate the comparison.

Check your reasoning and transfer it

1. 201-235 inclusive contains 35 serials. The located ranges contain 10 +10 +14 =34; serial 235 remains one unlocated suspect unit.

2. Hold/control the known ranges and give the missing sample trace to the quality event owner with a receiving person and review time. Do not silently add 235 to the cell count without confirmation.

3. A restart check concerns current process recovery. Complete product scope, verification and authorized disposition remain necessary, including the failed sample location and any further exposure identified.

Suggested completed record

Scope category	Serials / calculation	Count / decision
Initial scope	201-235	35 units
Located	10 +10 +14	34 units
Unlocated	Serial 235	1 unit; trace open
Closure	Not authorized by restart	Reconcile and disposition

Plausible wrong turns

1. The suspect interval is not automatically the entire final containment.

2. A matched total without traceable locations is not a complete reconciliation.

Evidence of a sound answer

1. Count both intervals inclusively and avoid double counting.

2. Keep the missing serial visible and assigned.

3. Distinguish containment, technical recovery and product release.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Named OCAP/quality event owner with each affected location owner
Record	Signal record, suspect-scope map, acknowledgments and disposition references
Review	At each handoff and before any release; timing follows the local reaction plan
Verification evidence	Validated checkpoint, traceable unique units, restoration verification and authorized dispositions
If unresolved	Maintain applicable controls, expand investigation and escalate unlocated or downstream exposure through the defined route.

Check your reasoning and transfer it

1. Cp=.20/(6x.025)=1.3333. Cpk=min(.08,.12)/(.075)=1.0667; the upper side limits the result.

2. These are calculations under supplied assumptions. A real unstable process lacks the fixed-distribution basis of this simple interpretation; acceptance still depends on applicable customer/organizational requirements and suitable evidence.

Suggested completed record

Index	Calculation	Rounded result
Cp	.20/.15	1.333
Cpk	.08/.075	1.067

Plausible wrong turns

1. Cp does not account for centering.

2. A synthetic normal curve is not a measured qualification.

Evidence of a sound answer

1. Use the nearest specification distance.

2. Preserve sigma and specification meanings.

3. Avoid inventing a universal passing value.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Capability-study owner with customer quality
Record	Study scope, measurement/baseline evidence, indices and applicable decision
Review	Before qualification and after material process changes
Verification evidence	Traceable data, suitable assumptions and authorized acceptance basis
If unresolved	Resolve instability or measurement gaps before using a capability index as decision evidence.

Check your reasoning and transfer it

1. Gauge variance=.000036+.000064=.000100mm², so SD=.010 mm. The SD share is .010/.050=20%; variance share is .0001/.0025=4%.

2. The .014 result incorrectly adds SDs. Representative parts/appraisers and a suitable analysis model still need evidence, as do relevant bias, resolution, stability or decision criteria.

Suggested completed record

Metric	Result	Unit or denominator
Combined gauge SD	.010	mm
SD share	20%	Total SD
Variance share	4%	Total variance

Plausible wrong turns

1. Standard deviations do not add as independent variances do.

2. A supplied component calculation is not an executed measurement study.

Evidence of a sound answer

1. Calculate in squared units and return to mm.

2. Label both percentages.

3. Separate arithmetic from measurement approval.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Measurement-system owner
Record	Study plan, raw readings, model, component labels and fitness decision
Review	Before use for a new decision and after material method changes
Verification evidence	Representative design and suitable measurement evidence
If unresolved	Improve the method or study design and reassess rather than changing percentage labels to appear acceptable.

Check your reasoning and transfer it

1. Overall agreement=(27+8)/40=87.5%. False acceptance among bad is 3/30=10%; false rejection among good is 2/10=20%.

2. The unequal reference groups weight the overall result differently. A single pass still cannot establish within-appraiser repeatability; blinded repeated classifications are needed for that question.

Suggested completed record

Metric	Numerator / denominator	Result
Agreement	35/40	87.5%
False acceptance	3/30	10%
False rejection	2/10	20%

Plausible wrong turns

1. 92.5% single-pass agreement is not repeatability.

2. The chosen reference mix is not automatically the production mix.

Evidence of a sound answer

1. Use the correct reference-group denominators.

2. Explain each error direction.

3. Keep reference uncertainty and repeated-study design visible.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Inspection-method owner
Record	Reference basis, item-level classifications, agreement/error summaries and action record
Review	After instruction changes and during planned measurement review
Verification evidence	Representative blind comparisons and resolved decision criteria
If unresolved	Clarify references or method, coach targeted errors and verify with new blinded opportunities.

Check your reasoning and transfer it

1. The row needs a suitable controlled method, approved sampling basis, actual reading/identity/time record, defined abnormality response and named restart/disposition authority. "Periodically" is not an executable interval.

2. A correct answer requests risk and detection/containment information before choosing a rate. Link the revised characteristic to PFMEA, control plan, measurement method and station instruction.

Suggested completed record

Gap	Required resolution	Do not invent
Sampling	Risk-based approved basis	A universal interval
Record	Actual value and identity	A green tick as measurement
Reaction	Controlled hold/escalation and verification	Automatic release after adjustment

Plausible wrong turns

1. A tolerance is not a complete control plan.

2. A proposed sampling interval is not an approved requirement.

Evidence of a sound answer

1. Make the row executable.

2. Preserve revision connections.

3. Separate process restart from product disposition.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process engineering with quality and station owners
Record	Linked risk/control/instruction revision and completed station records
Review	At launch, controlled changes and periodic effectiveness review
Verification evidence	Operators execute checks and responses with traceable values and verified authority
If unresolved	Repair the control or collection method and update linked revisions when a drill exposes a gap.

Check your reasoning and transfer it

1. 12.24 exceeds 12.20 by .04 mm. Preserve the note and timing/context, follow approved containment/escalation, and trace product identity using reliable process/material records.

2. The uncertain identity widens the investigation problem; it is not permission to assume one convenient lot. Restart and held-product disposition remain authorized decisions supported by separate evidence.

Suggested completed record

Issue	Required response	Boundary
Reading	12.24 vs 12.20: abnormal	Do not rewrite as pass
Identity	Reconstruct trace and exposure	Do not invent a lot
Restart/disposition	Verify through named roles	No automatic release

Plausible wrong turns

1. Remeasuring until a pass appears does not resolve the original abnormality.

2. A completed check requires a usable response, not just a signature.

Evidence of a sound answer

1. Preserve actual readings.

2. Make uncertainty visible.

3. Close both process and product responsibilities.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Station owner with quality and process support
Record	Actual check record, exposure map and verification ticket
Review	At each required check and at handover of unresolved abnormalities
Verification evidence	Traceable observations and authorized restart/disposition evidence
If unresolved	Escalate unresolved identity, method or recurrence gaps rather than closing on a later favorable reading.

Check your reasoning and transfer it

1. Cause: wrong label file selected; mode: incorrect label applied; effect: misidentified contents at the customer. A file/product identity control may prevent selection; a suitable scan may detect a mismatch, depending on what it actually checks.

2. The scan cannot be listed as an effective existing control before installation and verification. Use authorized mismatch challenges and update connected instructions/control-plan records after approved changes.

Suggested completed record

Element	Correct statement	Evidence status
Cause	Wrong file selected	Potential
Mode	Incorrect label applied	Potential failure
Effect	Customer receives misidentified contents	Relevant consequence
Proposed scan	Detection depends on design	Unverified

Plausible wrong turns

1. An action marked complete is not automatically effective.

2. Do not infer Action Priority from a made-up RPN threshold.

Evidence of a sound answer

1. Keep the failure chain coherent.

2. Distinguish proposed and existing controls.

3. Name evidence that tests the action.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process-risk owner and cross-functional team
Record	Failure chain, authorized evaluation, action evidence and controlled revisions
Review	At design/process changes and after relevant failures
Verification evidence	Verified control performance and aligned operational documents
If unresolved	Reopen the risk/action review when evidence exposes an unaddressed path or ineffective control.

Check your reasoning and transfer it

1. 2/3=66.7% administrative completion. That fraction does not establish readiness or the significance of the open measurement issue.

2. The method gap may undermine interpretation of validation results for the characteristic. Record the affected claims, required evidence, accountable decision and follow-up; do not declare launch approved from the count.

Suggested completed record

Item	Result	Meaning
Completion	2 of 3=66.7%	Task count only
Measurement	Unresolved	Dependent validation qualified
Gate decision	Authorized review required	No invented approval

Plausible wrong turns

1. A gate is not a task-count threshold.

2. Training attendance does not prove a reaction works.

Evidence of a sound answer

1. Identify the meaningful dependency.

2. Keep revision and authority explicit.

3. Carry open risk into the next review.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Launch leader and receiving process owners
Record	Gate evidence, decision conditions and controlled handover
Review	At defined gates and material changes
Verification evidence	Applicable evidence and verified operational readiness
If unresolved	Reopen affected dependencies and escalate unresolved authority rather than using completion percentage as release permission.

Check your reasoning and transfer it

1. The product revision is unchanged, but the process/tool scope changed. Determine the applicable customer notification/submission requirements and retain the relevant decision for T2.

2. A truthful statement is: internal checks complete; applicability of customer authorization to T2 not established from supplied evidence. The lesson does not determine whether a particular submission is mandatory without those requirements.

Suggested completed record

State	What is known	What is not established
Old decision	T1 scope	Automatic extension to T2
Internal checks	Completed	Customer authorization
Next step	Review applicable change requirements	Invented submission level

Plausible wrong turns

1. A submission receipt is not approval.

2. An unchanged part number does not prove unchanged process scope.

Evidence of a sound answer

1. Keep evidence tied to actual conditions.

2. Distinguish statuses accurately.

3. Name the authorized source of the decision.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Supplier quality and authorized customer interface
Record	Requirement-to-evidence map and retained decision/conditions
Review	At submissions, decisions and relevant changes
Verification evidence	Correct revision/production scope and explicit authorization status
If unresolved	Resolve scope or evidence gaps through the customer process before representing a submission as approved.

Check your reasoning and transfer it

1. Known dispositions sum 150+60+20=230, leaving 10 units unresolved. The rework mention may explain their path, but current status and identity must be verified before assigning them to WIP, shipment or scrap.

2. Do not add the ten again if they are already included in another total. Trace the rework input/output IDs, location and disposition records, then reconcile the final mutually exclusive statuses.

Suggested completed record

Calculation	Result	Action
Known status sum	230	Compare with 240 input
Unresolved difference	10	Trace rework identity/status
Closure	Quantity and destination evidence	No automatic complete label

Plausible wrong turns

1. Rework is not a separate extra quantity when already counted in a current status.

2. Balanced totals alone do not prove destinations.

Evidence of a sound answer

1. Identify the ten-unit gap.

2. Avoid double counting.

3. Close identity and location as well as quantity.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Traceability owner with warehouse and quality
Record	Genealogy, movement, status and drill-gap records
Review	At defined trace drills and after relevant process/record changes
Verification evidence	Complete identities, quantities and destinations across split/merge/rework
If unresolved	Repair record capture and verify a new trace opportunity when a drill exposes missing links.

Check your reasoning and transfer it

1. Completion 9/12=75%; findings 3/9=33.3% of completed checks. Neither is a product-conformance rate.

2. Reopen or qualify the email-only closure under the local process; identify the actual control, response and later observation needed to verify effectiveness. Preserve the action already taken without overstating what it proves.

Suggested completed record

Metric	Calculation	Meaning
Completion	9/12=75%	Scheduled activity
Finding rate	3/9=33.3%	Findings among checks
Closure	Email only	Effectiveness not established

Plausible wrong turns

1. More findings can reflect better observation rather than worse product.

2. A completed schedule is not proof of control effectiveness.

Evidence of a sound answer

1. Use the correct two denominators.

2. Write evidence rather than blame.

3. Verify the response at a relevant later opportunity.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Layered-audit coordinator and process owner
Record	Observation schedule, objective findings and effectiveness record
Review	At planned leadership reviews and follow-up observations
Verification evidence	Relevant coverage and verified control response
If unresolved	Improve questions, access or process conditions when repeated findings or superficial checks persist.

Check your reasoning and transfer it

1. Correct job/procedure identity does not fill the missing run segment. Preserve existing records and recollection as separately labelled evidence, then use the applicable technical/quality process to determine disposition and any permitted reconstruction.

2. Verify the corrected record-capture control on relevant later jobs. Do not fabricate missing measurements or use a remembered normal run as equivalent to required contemporaneous evidence.

Suggested completed record

Claim	Evidence status	Action
Correct procedure	Established by supplied identity	Retain
Required run conditions	Incomplete evidence	Authorized assessment
System fix	Not yet verified	Check later complete capture

Plausible wrong turns

1. A final visual check cannot automatically replace missing process evidence.

2. One program's approval does not establish another program's scope.

Evidence of a sound answer

1. Preserve original evidence and uncertainty.

2. Respect process-specific authority.

3. Separate disposition from record-system improvement.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Special-process engineering and quality owners
Record	Scoped job/procedure/run evidence and authorized deviation decisions
Review	At each required job review and after controlled changes
Verification evidence	Correct identity, applicable qualification and complete required records
If unresolved	Escalate missing or inconsistent evidence; verify the corrective control on later relevant work.

Check your reasoning and transfer it

1. State that North is preparing the specified NDT scope and has an open job-evidence gap; the supplied records do not establish North accreditation.

2. The process/qualification record owners must retrieve applicable evidence linking the person, role and job conditions, with reviewer verification and any necessary affected-job assessment. Do not invent qualifications or reproduce an official requirement not supplied.

3. The South record applies only to its actual scope, and the optional pre-assessment is preparation evidence, not an accreditation decision. Verify actual status through the authorized program records before any claim.

Suggested completed record

Record field	Applicable evidence	Decision / next owner
Scope	North / specified NDT	Preparation; no North decision supplied
Gap	ND71 personnel evidence linkage	Named process and qualification owners
Closure	Applicable job-specific evidence	Independent verification; assess implications
Status	South record / pre-assessment	Neither establishes North accreditation

Plausible wrong turns

1. A complete folder does not prove applicable, traceable evidence.

2. Pre-assessment, self-audit, formal audit and accreditation decision are distinct events.

Evidence of a sound answer

1. Keep site/process scope explicit and avoid an unsupported accreditation claim.

2. Define a specific missing link and retrievable closure evidence.

3. Explain why the plausible substitute evidence is insufficient.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Site quality lead with the responsible process and record owners
Record	Controlled preparation index linked to applicable criteria, actual job evidence and gap verification
Review	At preparation reviews and after each verified gap closure; use actual program requirements for scheduling
Verification evidence	Current scope/criteria references, traceable job records, closed-gap verification and separately verified accreditation status
If unresolved	Retain the open gap and address applicability through qualified owners/PRI channels; avoid unsupported external status claims.

Check your reasoning and transfer it

1. The configuration and ownership record support implementation; zero due events do not establish effectiveness in handling a due item.

2. Plan verification over relevant upcoming events and, where appropriate, an authorized workflow challenge. Current status should say action implemented, effectiveness evidence pending, with the responsible owner and review plan.

Suggested completed record

Evidence	Supports	Does not establish
Configured workflow	Implementation	Handling of a real due event
Two quiet weeks	No observed recurrence in that period	Effectiveness with zero opportunities
Next verification	Relevant event/challenge plan	A fabricated successful result

Plausible wrong turns

1. Relabeling alone does not correct overdue calibration.

2. No recurrence without opportunity is weak effectiveness evidence.

Evidence of a sound answer

1. Keep correction and corrective action distinct.

2. Link the action to evidence of cause.

3. Define meaningful verification opportunities.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Quality-system owner with metrology and product quality
Record	NCR, exposure assessment, correction, cause/action and effectiveness records
Review	At defined response reviews and relevant calibration opportunities
Verification evidence	Technical status restored, impact assessed and recurrence control tested
If unresolved	Reopen investigation or redesign the action when evidence contradicts the cause or the new control fails.

Check your reasoning and transfer it

1. Separate IATF 16949:2016 first edition from certification Rules 6, effective 1 January 2025. ISO/TS 16949:2009 is historical and replaced. The second edition's mid-2027 publication timing is indicative, not an established effective date.

2. Remove the unsupported certified claim until the applicable authorized site/scope/status evidence is verified. Assign an owner to monitor official updates and assess published transition requirements when available.

Suggested completed record

Incorrect claim	Corrected statement	Boundary
Sixth edition standard	Rules 6 is a separate document	Do not rename the standard
ISO/TS current	Historical replaced reference	Preserve historical records
Effective mid-2027	Indicative planned publication	No invented deadline
Certified	Status not established here	Require scoped evidence

Plausible wrong turns

1. A training pack does not certify an organization.

2. A publication plan is not a published or effective requirement.

Evidence of a sound answer

1. Distinguish all authority types.

2. Use a dated status check.

3. Avoid unsupported certification and transition claims.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Automotive QMS owner and customer interface
Record	Controlled authority/applicability register and scoped status evidence
Review	At official updates, customer changes and planned periodic review
Verification evidence	Current authoritative references with documented applicability
If unresolved	Clarify ambiguous requirements and assess published changes before updating operational commitments.

Check your reasoning and transfer it

1. Error=60−63=−3 fictional units. That is a comparison result, not an actuator command; the authorized control law and system constraints are not supplied.

2. Sensor feedback returns to the controller; controller output drives the actuator and process. A disturbance acts on the process. SPC examines measurements over time separately and does not validate an invented command.

Suggested completed record

Item	Result	Meaning
Error	−3 fictional units	Measurement above reference under this convention
Actuator output	Undetermined	Need authorized control law
SPC signal	Monitoring evidence	Not a tuning instruction

Plausible wrong turns

1. Error units do not become actuator percentages by assumption.

2. Statistical and engineering control are different mechanisms.

Evidence of a sound answer

1. Use the stated sign convention.

2. Preserve every feedback edge.

3. Avoid invented gains or operating commands.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Qualified controls engineer with process owner
Record	Controlled loop design, instrument status and monitoring-response records
Review	At approved changes and relevant abnormality reviews
Verification evidence	Valid measurement and verified behavior under authorized design
If unresolved	Investigate sensor/process/controller evidence through the qualified authority; never infer tuning from a teaching diagram.

Check your reasoning and transfer it

1. The numerical interval is 10.075-10.115 mm. Its upper end exceeds 10.100, but the lesson still does not supply the coverage meaning or decision rule needed for the conformity decision.

2. Retrieve the applicable rule, coverage and uncertainty evaluation, relevant calibration/correction evidence and authorized decision owner. Do not declare automatic acceptance or rejection, and do not create an ad hoc guard band.

Suggested completed record

Item	Result	Boundary
Interval	10.075-10.115 mm	Arithmetic, not a declared probability
Nominal comparison	10.095 below 10.100	Not a complete decision basis
Next step	Applicable rule and evidence	No invented guard band

Plausible wrong turns

1. Uncertainty is not an extra product tolerance.

2. Traceability and fitness for a specific decision are not identical.

Evidence of a sound answer

1. Calculate the interval correctly.

2. Retain missing coverage information.

3. Separate measurement evidence from acceptance authority.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Metrology owner and authorized conformity decision-maker
Record	Measurement result, calibration/corrections, uncertainty/coverage and decision basis
Review	At method changes, calibration findings and defined measurement reviews
Verification evidence	Traceable and fit-for-purpose results used with the applicable rule
If unresolved	Resolve missing evidence or improve the method before representing the result as an authorized conformity conclusion.