



QUALITY MANUALS | FIRST EDITION

IAF LEAN MANUFACTURING & SOP MANUAL

Standard work, process control
and reliable production

STABLE RELEASE

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Press, body joining, paint and assembly
Safe downtime reduction and recovery
Practical procedures and operating records

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Publication identity and use

IAF Lean Manufacturing & SOP Manual

This manual provides the requirements, operating procedures and evidence framework for its defined automotive manufacturing activities. Apply it through a controlled site implementation plan and equipment-specific work instructions.

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Reading and applying requirements

“Shall” identifies a requirement when adopted by a site, programme or agreement. “Should” identifies a recommendation. An example is illustrative; it is not a machine setting, test acceptance limit or completed operating record. Annex worksheets may be reproduced for controlled internal use.

Controlled implementation

Stable Release identifies the completed publication text. Site approval, process validation, competence authorization and equipment release are recorded when performed. A missing safety limit, test criterion or release authority prevents activation of the affected operation. Mandatory law, product requirements and validated equipment instructions remain applicable.

Relationship to IAF recognition

Use of this manual does not by itself confer membership, Corporate Recognised status, accreditation, certification or a licence to use IAF marks. Those decisions follow the applicable IAF guides, independent evaluation and recorded scope.

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Using the annexes

Enter actual values, evidence references, names and dates in the worksheets. A blank, unsigned or illustrative record is not proof of completion. Retain the record with its governing instruction and revision.

1 Purpose, scope and operating principles

1.1 This manual governs automotive production from received materials through press operations, body joining, pretreatment, paint, final assembly and manufacturing release. It applies to original equipment manufacturers, component plants, contract manufacturers and their controlled production services. A site shall identify its products, lines, shifts and outsourced processes in an applicability register.

1.2 The intended result is repeatable, safe production of conforming products with less waiting, movement, inventory, rework and equipment loss. Zero avoidable downtime is an improvement ambition. It shall never be interpreted as permission to suppress faults, omit maintenance, defeat safeguards or continue a process that is outside its approved limits.

1.3 The plant shall translate this manual into current work instructions, control plans, maintenance tasks and escalation arrangements. Product drawings, special characteristics, material specifications and equipment instructions establish the actual operating parameters. This manual does not supply universal press forces, weld settings, oven temperatures or fastening torques.

1.4 Where battery assembly, high-voltage commissioning or connected production systems are involved, IAF-MAN-GAA-001 and IAF-MAN-OTC-001 apply to their respective activities. One coordinated change and restart record may cover all three manuals, provided each responsible function records its own acceptance.

1.5 An exclusion shall identify the activity that is absent and its basis. Outsourcing a process does not remove the plant's responsibility to specify acceptance, verify supplier capability and retain evidence. Safety, product identity, truthful records and authorized release cannot be excluded.

2 Terms and common measurement rules

2.1 Standard operating procedure (SOP) means a controlled description of an operation, its prerequisites, sequence, critical points, acceptance criteria and response to abnormal conditions. Standardized work combines the approved work sequence, demand-based takt and necessary in-process stock. Standard work is a maintained baseline for improvement, not a barrier to reporting a better method.

2.2 Takt time is net available production time divided by customer demand in the same period. Cycle time is the measured time to complete a defined repeated process. Lead time includes processing and waiting across a defined boundary. A line may have an acceptable station cycle while carrying excessive lead time and inventory.

2.3 Work in process (WIP) includes identified material between receipt and finished release. First-pass yield is the proportion accepted at its first completed evaluation without rework. Scrap, rework and concession shall remain separate outcomes. A reworked unit may become saleable but does not retrospectively become a first-pass success.

2.4 Downtime is elapsed time in a defined non-running state within the agreed production window. Failure, setup, material shortage, quality hold and planned maintenance shall have distinct codes. Microstops are short interruptions below the site's documented reporting threshold; the threshold shall not erase their contribution to performance loss.

2.5 Overall equipment effectiveness (OEE) is availability multiplied by performance multiplied by quality, using consistent boundaries and units. MTBF is operating time divided by the number of defined failures. MTTR is the defined repair time divided by completed repairs. The report shall state whether MTTR includes waiting, diagnosis and verification; a zero denominator is reported as not applicable.

3 Responsibilities and stop-work authority

3.1 The Site Director owns resources, capacity commitments and implementation. The Production Manager owns shift execution and adherence to approved work. Process Engineering owns process design, validated parameters and technical changes. Quality owns control plans, nonconforming-product disposition and product release within delegated authority.

3.2 Maintenance owns equipment condition, planned work, repair records and technical readiness after intervention. Environment, Health and Safety (EHS) owns the site safety management arrangements and advises on risk controls. Authorized energy-control personnel apply equipment-specific isolation procedures. An operator authorization is not automatically an electrical or maintenance authorization.

3.3 The team leader shall verify staffing, competence, material status and start-up readiness before a shift. Operators shall perform their authorized tasks, inspect at the defined points, preserve traceability and immediately identify abnormal conditions. Every person may stop unsafe work and raise a quality concern without retaliation.

3.4 The logistics owner shall maintain replenishment, storage conditions, FIFO rules and segregation. The planning owner shall maintain the agreed production window and product mix. OT support shall control changes to recipes, PLC logic, machine accounts and production data through IAF-MAN-OTC-001.

3.5 Safety, technical readiness and product release are separate decisions. A manager may coordinate a restart but shall not sign on behalf of a technical function without the necessary competence and delegation. Absence cover and emergency contacts shall be available on every shift; production pressure does not enlarge a person's authority.

4 Process planning and production readiness

4.1 Before launching a product, Process Engineering shall define the complete material and information flow, including outsourced operations, buffers, inspection, rework, quarantine and final release. Each operation shall have an owner, equipment identity, approved input, output and acceptance gate. The flow shall identify where product identity can be lost or mixed.

4.2 The team shall evaluate foreseeable process failures and their effects on workers, vehicle users, downstream operations and the environment. High-consequence characteristics shall receive specific prevention and detection controls. The analysis shall connect to the control plan, SOP and reaction plan; separate documents with inconsistent process steps are not acceptable.

4.3 Capacity planning shall include product mix, changeovers, planned maintenance, realistic yield, staffing, learning curves and shared resources. A theoretical machine rate shall not be presented as deliverable line capacity. The bottleneck shall be verified through observations and recorded times under representative operating conditions.

4.4 Before production release, verify equipment acceptance, guarding, utilities, measuring capability, trial results, material approval, tool life controls and staff competence. Trial parts shall be identified and dispositioned. Any temporary control shall have a reason, owner, expiry and defined method for preventing unintended shipment.

4.5 A readiness review shall record open actions and decide full release, restricted controlled trial or no release. Unresolved safety controls, unidentified product, missing critical acceptance criteria or an incapable measurement method prevent release. Reassess readiness after relocation, substantial process changes or prolonged shutdown.

5 SOP creation, verification and revision

Owner: Process Engineering. Trigger: a new operation, approved improvement, changed product or equipment, incident learning, or an obsolete instruction. Output: a usable instruction approved before routine production.

Step / owner	Required action and evidence
1 Define the task	Identify station, product family, SOP number, revision, prerequisites, required competence and links to drawings, control plan and risk assessment. Separate normal operation from maintenance and abnormal recovery.
2 Observe and write	Observe representative work with experienced operators. Divide it into ordered steps. For each step state the critical point, reason, equipment, required check and response if the check fails.
3 Set acceptance	Reference the approved parameter schedule and inspection method. Use units and tolerances. Define what is recorded, sampling frequency, product hold boundary and who may authorize continuation.
4 Verify on site	Trial the instruction under controlled conditions. Confirm sequence, access, ergonomics, cycle assumptions, variant selection, traceability and understandable language. Record operator feedback and deviations.
5 Approve and deploy	Obtain Process, Quality and relevant EHS/Maintenance acceptance. Issue the controlled version at the workstation. Withdraw superseded copies and train affected personnel before independent use.
6 Review effectiveness	Observe the first deployment on each affected shift. Check quality and abnormal events. Update under change control; retain the prior revision and the reason, approver and actual implementation date.

An electronic instruction shall remain accessible during the approved continuity mode. A handwritten workaround, screen photograph or supplier demonstration does not replace a controlled SOP. Use Annex A to create a station-level instruction.

6 Standard work, takt and line balance

6.1 The planning function shall establish net available time and demand for each planning period and product family. Breaks and other excluded time shall be stated. The resulting takt sets a planning reference; it is not a justification for rushing work beyond ergonomic or machine limits. Demand changes shall trigger a review of staffing, mix and replenishment.

6.2 Process Engineering shall measure manual work, machine time, walking, waiting and overlap separately. Observe multiple representative cycles and variations; document the sample and conditions. Do not use a single fastest cycle as the standard. Required quality checks and safe handling remain part of the work content.

6.3 Balance work within the capabilities of people, equipment and material supply. Where takt cannot be met, first address bottlenecks, variation and unnecessary movement. Changes to work allocation shall be trialled for simultaneous access, pinch points, lifting, cognitive load and inspection effectiveness.

6.4 Define the minimum controlled WIP necessary to support the sequence and the maximum permitted buffer. Show where material is placed, how the next item is selected and what happens when a buffer is empty or full. Excess WIP shall not conceal a recurring equipment or quality problem.

6.5 The team leader shall compare observed performance with the current standard and collect improvement suggestions. A revised standard requires approval, training and confirmation of the new quality and safety outcome. Preserve the previous baseline so that the benefit can be assessed honestly.

7 Material flow, pull systems and visual control

7.1 The value-stream owner shall maintain a current-state map showing process times, inventory, changeovers, information triggers and release points. A future-state proposal shall have measurable objectives and a practical implementation sequence. Improving one station shall not create unmanageable queues or quality risks elsewhere.

7.2 Pull signals shall identify item, quantity, source, destination, container and replenishment trigger. Kanban quantities shall be calculated from actual replenishment time, demand variation and an approved buffer rationale. The site shall review them after product mix, supplier reliability or container changes.

7.3 FIFO lanes shall have visible entry and exit, capacity and status. Exceptions require identified material and authorization. Expiry-limited chemicals, sealants and other materials shall follow their approved remaining-life rules where these are stricter than FIFO. Unlabelled containers shall be held.

7.4 Andon indications shall distinguish safety, quality, maintenance and material needs. Each signal shall reach a named role and display whether help has been assigned. Local response targets shall reflect risk; a red safety or critical quality condition shall not wait for the next production meeting.

7.5 Daily visual boards shall show actual output, first-pass quality, lost time and open actions against the same shift boundary. Record the cause of missed demand rather than moving it to another shift. Abnormalities shall be connected to action owners and evidence of resolution, not only displayed as totals.

8 Press shop: coil, blank and die preparation

Applies before every new material lot, die change or press setup. Only trained and authorized personnel may perform rigging, die setting and hazardous-energy control. Specific equipment instructions govern the safe method.

Step / owner	Required action and evidence
1 Material acceptance	Verify coil or blank identity, grade, thickness, width, surface condition and lot certificate against the production order. Record substitutions or hold mismatches. Protect edges and restrain material using approved handling equipment.
2 Die readiness	Verify die number, engineering revision, condition, maintenance status, lifting points and permitted press compatibility. Inspect safety blocks, clamps, connections and sensors under the approved isolated condition.
3 Safe change	Execute the equipment-specific isolation and stored-energy procedure. Control mechanical, hydraulic, pneumatic, electrical and gravity hazards. Establish exclusion and lifting arrangements; do not work beneath an unsupported load.
4 Setup verification	Fit and secure the die using the approved method. Load only the released recipe. Verify feed alignment, material support, lubrication and scrap evacuation settings against the parameter sheet.
5 Safeguard checks	Complete the specified checks of guarding, interlocks, stop functions and setup mode. Record the competent verifier. A defective safeguard prevents the press from entering production.
6 Trial authorization	Clear the area and authorize the controlled trial. Identify trial blanks and retain first-piece dimensional and visual results. Quality and Process Engineering release the defined part and setup combination.

Hold the press if the material, die, recipe or protective arrangement does not match the job. Schedule gain is not an acceptable reason to omit die verification or first-piece approval.

9 Press shop: production and abnormal recovery

Operate only the approved press, die, material and recipe combination. The control plan shall specify dimensional, surface and special-characteristic checks, sample intervals and die wear limits.

Step / owner	Required action and evidence
1 Start the lot	Verify first-piece approval, coil or blank traceability and the receiving container. Confirm sensor checks, lubricant status, scrap paths and material feed before the approved production start.
2 Monitor the run	Observe the specified load or tonnage trends, feed status, lubrication, tool-life counter and part quality. Use limits established for this setup. Record checks at the control-plan interval and after defined disruptions.
3 Detect abnormality	For double feed, misfeed, part sticking, unexplained load changes, damaged tooling or guard faults, stop using the appropriate control. Notify the team leader and maintenance; identify parts since the last verified good check.
4 Recover safely	Do not reach into the danger zone or repeatedly reset a fault. Authorized staff assess the condition and apply the relevant isolation, blocked-load and recovery instruction. Record cause and work performed.
5 Requalify the setup	After tool work or a relevant adjustment, verify safeguards and the released recipe. Produce identified trial parts and repeat affected dimensional and surface checks. Re-establish the last known good boundary.
6 Close the run	Identify final quantities, rejects and remaining material. Inspect the last piece when required, record die condition and maintenance needs, and transfer the approved lot with its traceability record.

Tool damage may affect earlier output even when the current sample passes. Quality shall define the retrospective containment range using wear, load history, inspections and the actual failure evidence.

10 Body joining: welding and bonded assemblies

Applies to resistance, arc and laser welding, brazing, adhesive bonding and mixed-material joining when present. Each joining technology shall have its own qualified instruction and validated parameter range.

Step / owner	Required action and evidence
1 Verify inputs	Check part identity, material pairing, coating, joint cleanliness, fixture revision and consumable life. Confirm welding equipment, extraction and applicable laser or radiation protective arrangements are ready.
2 Select the job	Load the authorized weld or dispense programme linked to the body variant. Verify electrode, wire, gas, nozzle, adhesive and tooling identity. Protect parameter access from unauthorized adjustment.
3 Confirm first-off	Validate locating points, clamping, fit-up and joint sequence. Perform the specified visual, dimensional and joint-strength checks. Destructive sample results shall link to the representative process and material combination.
4 Control production	Capture joint completion and defined process signatures. Maintain electrode dressing, tip replacement and adhesive open-time controls. Missing welds, incomplete cure conditions or out-of-window signals trigger containment.
5 Respond to failure	Stop the affected process and define bodies produced since the last valid verification. A signal within range does not by itself prove joint strength. Quality and Engineering decide additional testing, repair or scrap.
6 Release and trace	Record part or body identity, programme revision, material lots, equipment and inspections. Authorize repair through a validated route and repeat affected checks before transferring the assembly.

Changes to joint stack, coating, adhesive, electrode geometry or robot path require impact assessment. Do not add welds or heat input as an informal repair; structural performance and corrosion protection may be affected.

11 Paint shop: pretreatment and electrocoat

The paint process owner shall maintain the approved chemistry, bath, rinse, filtration, environmental and waste-control schedule. Product acceptance requires both process evidence and the defined coating results.

Step / owner	Required action and evidence
1 Receipt and cleanliness	Verify body identity, upstream release and absence of incompatible sealants, oils or foreign material. Protect drain paths and contact points. Hold visible contamination until the approved cleaning disposition is complete.
2 Chemical readiness	Check chemical identity, concentration method, bath condition, replenishment authorization and instrument status. Confirm ventilation, spill controls, containment and exposure precautions for the chemicals used.
3 Process the body	Use the approved sequence and dwell conditions. Record bath measurements, alarms, line speed and critical replenishments. Prevent incompatible chemical additions and preserve operator identity for adjustments.
4 Rinse and drain	Verify rinse quality and carry-over controls at the specified points. Inspect drainage and body cavities. Excess drag-out or blocked drains shall trigger investigation of both coating quality and chemical consumption.
5 Coat and cure	Use the released electrical and cure programme. Verify actual substrate thermal profile under the qualified method; oven air display alone is insufficient evidence of the body's cure history.
6 Verify output	Assess thickness, coverage, appearance, adhesion and specified performance tests. Link samples to process conditions and body lots. Hold output after a relevant excursion until the technical impact has been assessed.

No generic bath concentration, voltage or cure temperature is prescribed here. Engineering shall identify approved numerical limits and test methods for each chemistry and body configuration, including materials sensitive to heat.

12 Paint shop: application, ovens and finish

Applies to primer, basecoat, clearcoat, powder coating, sealers and related finish operations. The site shall control flammable atmospheres, chemical exposure, ventilation, ignition sources and combustible residues as applicable.

Step / owner	Required action and evidence
1 Prepare materials	Verify coating system, colour, batch, shelf life, mixing ratio and usable life. Record mixing and replenishment. Keep approved samples or reference panels where the control plan requires them.
2 Verify the booth	Confirm extraction, filtration, required airflow indication, housekeeping and application equipment condition. Interlock failures or loss of essential ventilation prevent affected spraying; notify EHS and Maintenance.
3 Apply coating	Load the correct programme and use the validated application parameters. Monitor environmental conditions and material supply. Protect against variant mix-up, contamination and unrecorded manual parameter changes.
4 Control ovens	Verify the released thermal cycle, exhaust and protective systems. Track residence interruptions and substrate temperature evidence. Assess the effect of a conveyor stop on every body in the heated zone.
5 Inspect finish	Check film build, colour match, surface defects and specified functional coating performance using suitable lighting and calibrated equipment. Define defect zones and repeatable acceptance boundaries.
6 Repair or release	Use a qualified repair route with controlled sanding, cleaning, recoat and cure. Record repaired areas and repeat applicable checks. Confirm downstream adhesive and trim compatibility before release.

Fire or exposure alarms follow the emergency plan. A production leader shall not restart ventilation-dependent work by masking an alarm. Heating limits for batteries or other installed sensitive components shall be verified before any relevant body enters an oven.

13 Final assembly: sequence and built-in quality

The assembly owner shall maintain one controlled build configuration linking the body, powertrain or battery, options, parts and software requirements. A build mismatch shall stop the affected release route.

Step / owner	Required action and evidence
1 Start the station	Verify the product identifier, released work instruction, variant-specific kit, tool status and predecessor acceptance. Reject unapproved substitute parts and resolve unreadable identifiers before assembly.
2 Assemble in sequence	Follow the validated order for locating, fastening, routing and joining. Protect connectors, sealing surfaces and restraints. Critical concealed features shall be checked before the next operation makes them inaccessible.
3 Apply error proofing	Confirm part-presence, orientation and tool-program checks. Test challenge samples at the defined interval. A failed error-proofing device triggers the reaction plan and an identified product hold.
4 Capture results	Record critical fastening, dispensing, leak, electrical and functional outcomes against the unit. A station completion flag shall only be set after required checks pass or a valid controlled disposition is recorded.
5 Manage rework	Route defects to an identified repair area or approved in-station method. Preserve removed-part identity where needed. Rework shall not overwrite the initial failure or bypass affected downstream tests.
6 Transfer safely	Verify equipment and vehicle movement readiness, open quality holds and material status. Release to the next station only through the approved signal; prevent a bypassed unit from entering the shipping flow.

EV battery mating and energized commissioning additionally follow IAF-MAN-GAA-001. Initial software loading and security provisioning follow IAF-MAN-OTC-001. The assembly record shall link those results without reproducing restricted secrets.

14 Fastening, dispensing and special processes

14.1 Engineering shall classify joints by consequence and prescribe tool programme, fastener, lubrication condition, sequence and acceptance method. Torque, angle, force or displacement limits shall come from validated product requirements. A tool's calibration does not validate the joint design or compensate for the wrong fastener.

14.2 Before use, verify tool identity, programme, calibration or verification status and the intended joint. Challenge part and programme selection controls. Record tool result, unit identity, joint location and time for characteristics requiring traceability. A green controller light without a valid unit association is incomplete evidence.

14.3 For an interrupted or failed fastening cycle, follow the approved joint-specific disposition. Do not repeatedly tighten until a pass appears. Engineering shall define whether loosening, replacement, inspection or a controlled rerun is permitted and which components are single use.

14.4 For dispensing and bonding, control material batch, storage, conditioning, mix ratio, application quantity, bead location, open time and cure conditions. Verify line purging, nozzle changes and pause limits. Exceeding a time or environmental limit places affected assemblies on hold.

14.5 Heat treatment, coating, welding and other processes whose results cannot be fully verified by subsequent inspection require demonstrated process capability and controlled conditions. Supplier approval, periodic validation and change control shall cover the actual process and part family, not only the supplier's general quality certificate.

15 Control plans, measurement and reaction plans

15.1 The control plan shall identify operation, characteristic, specification, measurement method, sample rule, responsible role, record and reaction. Special characteristics shall be consistently marked across drawings, process risk analysis and work instructions. Inspection effort shall address consequence and detection capability, not only ease of measurement.

15.2 Quality shall confirm that each measurement system is suitable for its tolerance, range, environment and intended decision. Evaluate repeatability, reproducibility or other relevant uncertainty and bias. Reference samples shall have identity, condition and validity controls. A calibration label alone is not proof that a method can discriminate acceptable parts.

15.3 Use statistical process monitoring where its assumptions and sampling design are appropriate. Control limits describe observed process behaviour; specification limits define product acceptance. A statistically stable process can still be incapable. A passing sample does not cancel a special-cause signal or justify release of an unidentified population.

15.4 The reaction plan shall require containment from the last known valid verification, confirmation of the measurement, evaluation of cause and authorized recovery. Record actual suspect quantities, locations and serial or lot boundaries. Where evidence cannot establish a boundary, widen containment conservatively.

15.5 Quality shall authorize disposition as use-as-is only where the requirement owner permits it, rework, repair under approved concession, return or scrap. Concessions shall identify scope, expiry and customer authorization when required. Critical safety or mandatory requirements shall not be waived by local production management.

16 Traceability, segregation and nonconforming output

16.1 The plant shall define the traceability depth needed for materials, safety-relevant components, special processes and product configuration. The genealogy shall connect supplier lot, station or process, equipment recipe, inspection evidence and finished unit. Repacking, split lots and merging containers shall preserve the relationship.

16.2 Physical and electronic status shall agree. Quarantine shall prevent use and shipment through access controls, identified locations and system blocks. Colours alone are insufficient where labels can detach or personnel cannot distinguish them. Unknown status is held status until verified.

16.3 After a defect, Quality shall establish the last known good point and include off-line buffers, rework, subcontracted material, finished stock and goods already shipped where relevant. Notify affected parties through the established product-safety and customer communication route. Do not wait for root cause before necessary containment.

16.4 Rework shall use a released method, authorized staff and repeat testing of all affected characteristics. Preserve the original result and link the correction. Scrap shall be rendered unavailable for unintended use through an approved method appropriate to its safety and environmental risks.

16.5 At least annually, the site shall exercise traceability using a representative critical component or process event. Measure whether affected units and destinations can be identified and reconciled with quantities. Record gaps, actions and retest evidence rather than declaring success from a single easy-to-trace sample.

17 Changeovers and safe SMED improvement

Owner: Production and Process Engineering with Maintenance. Single-minute exchange of die (SMED) is a structured reduction method; the name is not a mandatory time limit. Safety and first-piece release are part of the approved changeover.

Step / owner	Required action and evidence
1 Establish baseline	Measure the defined last-good-to-first-good interval. Separate preparation, isolation, removal, installation, adjustment, checks, trial and release. Retain the actual method and product combination.
2 Prepare externally	Stage verified tooling, materials, lifting equipment, programmes and personnel before the stop where this can be done safely. External preparation shall not expose people to running equipment hazards.
3 Reduce waste	Improve access, identification, transport and repeatable locating. Evaluate pre-setting and suitable quick connections through engineering review. Do not convert an isolated task into live work to reduce minutes.
4 Execute the change	Use the current changeover checklist and equipment-specific energy control. Verify removal of previous material, tooling, labels and recipes so that mixed parts cannot enter the next batch.
5 Validate the setup	Check secure installation, utilities, safeguards, selected programme and critical adjustments. Run controlled trial pieces and obtain required first-piece acceptance before normal production.
6 Stabilize and improve	Track early-run losses, defects and repeated adjustments. Update the SOP only after the new method proves safe and repeatable across representative shifts. Record the change and training evidence.

Changeover performance shall include the time needed to produce a conforming released unit. Reporting only mechanical tool exchange can hide adjustment and quality losses.

18 Maintenance, condition monitoring and spares

18.1 Maintenance shall classify equipment by safety, quality, throughput and recovery consequence. The plan shall combine manufacturer tasks, statutory checks, operating experience and condition evidence. Each task shall identify interval or trigger, method, competence, isolation needs, parts and acceptance criteria.

18.2 Operator care may include authorized external inspection, cleaning or replenishment at safe access points. It shall not extend to guard removal, electrical enclosures, moving mechanisms or hazardous-energy work without separate authorization. The task boundary shall be visible in the work instruction.

18.3 Condition monitoring shall identify the failure mode being detected, sensor location, baseline, alarm rule and response owner. Trending vibration, temperature or lubricant condition is useful only if the signal is reliable and acted upon. A sensor fault shall not be silently converted into a normal reading.

18.4 Critical spares shall have approved specification, location, minimum stock rationale, preservation and replacement compatibility. Shelf life, firmware, calibration and obsolescence shall be considered. A visually similar replacement shall not be installed without verifying its safety and functional equivalence.

18.5 Close a maintenance order with findings, actual work, parts, measurements and readiness evidence. Deferred work requires a documented risk decision, compensating controls and a deadline. Safety-critical defects or failed protective functions prevent operation; a backlog target cannot authorize their deferral.

19 Downtime classification and loss elimination

19.1 The site shall publish a single loss dictionary with event start and end definitions, source systems, reason codes and responsible validators. Record machine stoppages separately from line stoppages. Several stopped assets during one line interruption shall not be added together as if they were sequential line losses.

19.2 A shift record shall retain the original event time and subsequent cause corrections with author and reason. Initial “unknown” coding is acceptable during response; unresolved causes require follow-up. Fault occurrence, help request, arrival, repair completion and production restart shall be distinguishable where response analysis needs them.

19.3 Rank losses by lost output at the system constraint, recurrence, safety consequence and cost of poor quality. A long stop on a non-constraining machine may not reduce line output; a short repeated bottleneck interruption may matter more. Use both frequency and duration rather than only a total-minute ranking.

19.4 For each priority loss, define a measurable problem, evidence, owner, containment, root-cause investigation and verified countermeasure. Typical actions include improved maintenance access, reliable material supply, validated error proofing, stable recipes and spare availability. Moving a loss into another code is not improvement.

19.5 Review results at shift level, recurring causes weekly and system performance monthly as site management controls. Include planned maintenance compliance, near misses, quality holds and defect escapes alongside OEE. The programme succeeds through fewer avoidable failures while necessary stops remain visible and properly controlled.

20 Breakdown response and safe intervention

Owner: shift leader coordinates; authorized maintenance personnel perform technical work. Immediate life-safety or environmental events follow the emergency plan before normal breakdown administration.

Step / owner	Required action and evidence
1 Stop and identify	Use the appropriate stop function; protect people and identify equipment, fault indication, product and time. Do not repeatedly reset, reach into equipment or remove a guard to keep the line moving.
2 Contain the process	Hold suspect material and prevent upstream or downstream accumulation that could create additional risk. Preserve fault messages and process data where safe. Assign a named incident coordinator.
3 Diagnose safely	Maintenance reviews symptoms and equipment history. Select the approved diagnostic method and required safe state. Energized testing, where lawful and necessary, needs its own qualified authorization and protective arrangements.
4 Control energy	For intervention requiring isolation, apply the machine-specific procedure covering all energy sources and stored energy. Verify the safe state using the prescribed method before work. Coordinate contractors and group work.
5 Repair and verify	Record cause, replacement parts and changed settings. Complete inspections, functional checks and any affected safeguard validation. Update the configuration baseline if an approved change was made.
6 Hand over	Maintenance records technical readiness and remaining restrictions. Production, Quality and relevant EHS/OT functions complete the restart gate in Section 21. Keep the loss event open until its defined end condition is met.

If the cause is uncertain, a reset is not a demonstrated repair. A controlled diagnostic run may be authorized with bounded scope and monitoring, but shall not be represented as unrestricted production readiness.

21 Controlled restart and product release

This gate applies after breakdown, guard intervention, recipe or software change, extended stop, utility loss, quality excursion and other triggers identified in the control plan. Use Annex C.

Step / owner	Required action and evidence
1 Confirm technical state	Maintenance and Engineering verify the completed work, equipment configuration, tools, utilities, connections and prescribed protective checks. Close or formally disposition every relevant work order.
2 Return control safely	Authorized personnel complete the equipment-specific energy restoration procedure. Confirm all workers and tools are clear and affected personnel are informed. Lock removal follows the site procedure, not a supervisor shortcut.
3 Verify the process	Check product and material identity, recipe revision, traceability, measurement status, consumables and environmental conditions. Establish how any material left in the machine or oven will be dispositioned.
4 Run controlled output	Authorize a limited trial in the approved mode. Identify trial units and monitor the corrected failure mode. Quality performs the specified first-off and affected characteristic checks.
5 Decide release	Production confirms operating readiness; Maintenance confirms equipment readiness; Quality releases product. Obtain EHS, Engineering or OT acceptance where their controls changed. Record people, evidence, restrictions and time.
6 Observe stability	Apply heightened monitoring for a stated duration or quantity based on the event. Define the failure threshold requiring a new stop. Close the event only after stable operation and product disposition are demonstrated.

An empty sign-off box means the gate is incomplete. A manager's instruction to meet the schedule does not replace a missing test, unidentified product boundary or failed protective function.

22 Problem solving and corrective action

22.1 Use a structured record for recurring, severe or unexplained losses and defects. Define what happened, where, when, on which variants and how often. Compare expected and actual behaviour with evidence. Avoid conclusions such as “operator error” that merely rename the observation.

22.2 Containment protects current customers and operations; correction fixes the immediate condition; corrective action addresses the verified cause. Assign separate owners and due dates where needed. A repaired component or retrained operator alone does not demonstrate that recurrence has been prevented.

22.3 Investigate technical, organizational and detection causes. Use cause-and-effect analysis, comparison of good and bad conditions, controlled tests and repeated observations. Five-why questioning can structure the inquiry but does not prove a hypothesis. Trials shall remain within approved safety and product boundaries.

22.4 Validate the countermeasure before broad deployment. State the expected effect, measurement, comparison period, sample coverage and adverse effects to watch for. Review performance across shifts, product variants and the relevant maintenance cycle. A brief absence of failures is insufficient for a rare but severe event.

22.5 Update risk analysis, control plans, SOPs, training and maintenance where the learning changes their assumptions. Search for similar equipment or products that share the cause. Quality closes the action after evidence of implementation and effectiveness; unresolved risk remains visible to management.

23 Engineering change and supplier control

23.1 Every change to material, tooling, process parameters, sequence, software, location or inspection shall have an identified request and impact review before use. Engineering shall evaluate safety, product function, capacity, traceability, serviceability, environmental controls and existing approvals.

23.2 The change plan shall state affected products and lots, required trials, acceptance criteria, customer notification or approval, implementation boundary and rollback conditions. A successful sample does not prove every variant or operating condition. Coverage and limitations shall be explicit.

23.3 Suppliers shall receive the current specification and change-notification obligations. Supplier assessment shall match the criticality of the outsourced process. Purchasing shall not approve a substitution solely because it has the same commercial description or a lower price.

23.4 At implementation, segregate old and new revisions, update system configuration and station instructions, train personnel and record the first affected unit. Manage remaining stock and service obligations deliberately. Verify that downstream test and logistics systems recognize the new configuration.

23.5 Temporary deviations shall be numbered, limited by time and quantity, and approved by the relevant requirement owner. Expiry shall block further use. Emergency changes still require minimum risk evaluation, traceability and prompt formal review; they shall not create a permanent undocumented process.

24 Competence, ergonomics and shift management

24.1 The site shall maintain a skills matrix identifying each person's authorized stations, special tasks, supervision needs and review dates. Authorization shall be based on demonstrated performance using the current instruction, including abnormal situations. Attendance at training alone is insufficient.

24.2 Provide instructions in a language and format understood by the worker. Training shall explain critical points and reasons, demonstrate the task, observe supervised performance and verify independent execution. Reassess after material process changes, extended absence or evidence of unsafe or unreliable work.

24.3 Engineering and EHS shall assess manual handling, repetition, reach, force, awkward posture, noise, heat and cognitive demands. Use task and workplace redesign before relying only on rotation or personal protective equipment. Rotation shall not move the same exposure among several equally demanding jobs.

24.4 Shift handover shall identify active holds, temporary deviations, maintenance restrictions, material changes, open alarms and expected high-risk work. The incoming leader shall acknowledge the actual condition of the line and assign unresolved actions. Oral handover shall be supported by a retained record.

24.5 Contractors and temporary staff shall receive relevant site induction, competence verification and coordination. Fatigue, understaffing or language gaps shall trigger a staffing or production-plan adjustment. No person shall be penalized for reporting an unsafe condition or refusing an unauthorized task.

25 Layered checks, audits and management review

25.1 Layered process checks shall verify that critical controls are functioning at the workstation. They shall sample actual practice, approved instructions, material identity, protective checks and reaction to abnormalities. A checklist signed from an office does not demonstrate process verification.

25.2 Internal audits shall follow the product and its records across shifts, rework, subcontracted processes and final release. Select samples by consequence and change history, including difficult cases and prior failures. Auditors shall be competent and sufficiently independent of the work examined.

25.3 Classify findings by their impact and require immediate containment for unsafe conditions, unapproved process changes or unreliable release evidence. Record the requirement, observation, affected scope, responsible owner and deadline. An audit score shall not conceal a critical finding.

25.4 Management shall review at least annually the system's suitability and effectiveness, with more frequent operating reviews for active losses. Inputs shall include quality, safety, capacity, maintenance backlog, supplier performance, traceability tests, changes and improvement outcomes. Decisions shall identify resources, priorities and accountable owners.

25.5 The document owner shall review this manual after significant technical or legal change and periodically under IAF-GUI-DOC-001. Plant procedures may be more specific or more stringent. Any conflict affecting safe operation or product release shall be resolved before the affected task continues.

26 Performance, sustainability and implementation

26.1 The site shall define a balanced set of measures: delivery against agreed demand, first-pass yield, scrap and rework, OEE at the relevant constraint, maintenance compliance, recurring failures, safety observations and energy or material use per conforming unit. Each measure shall have an owner, formula, source, period and action rule.

26.2 Do not compare OEE across plants without aligning product mix, ideal cycle definitions, production windows and loss treatment. Performance over 100 percent indicates a baseline, counting or timing problem requiring investigation. Reworked units shall not be double-counted to improve quality or throughput.

26.3 Resource reduction shall protect process capability and environmental controls. Lowering ventilation, cleaning, curing, cooling or maintenance solely to save energy is unacceptable without technical validation. Track consumption with relevant drivers so that lower output is not mistaken for efficiency improvement.

26.4 Implementation shall begin with a scope and gap review, then approved critical SOPs, competence and reaction plans, a representative pilot, evidence review and controlled expansion. Annex F provides a staged plan. A calendar target does not authorize deployment with unresolved critical controls.

26.5 After deployment, compare the baseline and result over representative shifts and variants. Retain unsuccessful trials and the reasons for rejection. Improvement remains open until the new method is reflected in actual work, records, training and sustained process performance.

Annex A Station SOP worksheet

Form reference: LMS-A. Duplicate for each station and controlled revision. Complete before operational use; attach the approved parameter and risk schedules.

Field	Entry / evidence
Identity	SOP no.: _____ Revision: ____ Station / asset: _____
Applicability	Product / variants: _____ Drawing / programme revision: _____
Prerequisites	Competence: _____ Safe state / protective checks: _____
Inputs and tools	Material / lot: _____ Tools / gauges: _____
Linked controls	Risk assessment: _____ Control plan: _____

Step	Action / critical point / reason	Acceptance / response / record
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

Abnormal stop and escalation: _____

First-piece / restart conditions: _____

Verified by / date: _____ Approved by / date: _____

Operator demonstration and deployment evidence: _____

Annex B Process control plan worksheet

Form reference: LMS-B. Use one row per characteristic; add sheets without changing the field meanings. Numerical limits shall reference the approved product or process specification.

Required field	Entry / instruction
Process identity	Line: _____ Operation: _____ Product family: _____
Requirement	Characteristic: _____ Special designation: _____
Acceptance	Specification / revision: _____ Limits and units: _____
Measurement	Method / gauge: _____ Capability evidence: _____
Sampling	Frequency / quantity / rationale: _____
Responsibility	Operator: _____ Verification authority: _____
Record	System or form: _____ Unit / lot association: _____
Reaction	Stop condition: _____ Last-good boundary method: _____
Disposition	Containment location: _____ Release authority: _____
Review	Process / Quality approval and date: _____

Control-plan completeness check

Confirm that every critical process risk has a prevention or detection control and a workable reaction. Walk a suspect part through the actual hold, rework and release routes. Verify that the person expected to respond is available on each shift.

Change trigger and next review: _____

Annex C Restart and first-off release record

Form reference: LMS-C. Event: _____ Asset / line: _____ Date / shift: _____ Product / lot boundary: _____

Gate	Result / evidence / verifier
Work completed	Work order, parts and configuration: _____
Safe restoration	Isolation return and area-clear record: _____
Protective functions	Required validation / test results: _____
Process conditions	Recipe, utilities, material and environment: _____
Measurement status	Gauges, test equipment and error proofing: _____
Trial population	Unit IDs / quantity / controlled mode: _____
First-off results	Characteristics, limits and measured evidence: _____
Suspect stock	Hold range and disposition: _____
Monitoring	Duration / quantity, owner and stop threshold: _____

Decision role	Name / date / decision
Maintenance / Engineering	_____
Production	_____
Quality release	_____
EHS / OT, where relevant	_____

Decision: release / restricted trial / remain stopped. Restrictions and expiry: _____

A “not applicable” entry requires a reason. Attach actual results; this checklist alone does not demonstrate a successful test.

Annex D Downtime and corrective-action log

Form reference: LMS-D. Asset boundary: _____ Shift window: _____ Data source / time basis: _____ Validator: _____

Event field	Entry
Identity	Event no.: _____ Product / programme: _____
Time record	Stop: ____ Help requested: ____ Arrival: ____ Repair complete: ____
Restart / loss	Release: ____ Stable output: ____ Counted loss duration: ____
Classification	Initial code: _____ Confirmed code / reason: _____
Consequence	Affected units / WIP: _____ Safety / quality impact: _____
Response	Containment: _____ Work order: _____
Cause	Evidence / tested hypothesis: _____
Countermeasure	Action: _____ Owner: _____ Due date: _____
Effectiveness	Metric / observation period / result: _____
Closure	Verifier / date: _____ Linked SOP or plan change: _____

Aggregation rule

For simultaneous asset stops, identify the line-level constraint and count elapsed line loss once. Keep asset events for maintenance analysis. Separate planned, unplanned, setup, shortage and quality-hold causes. Explain corrections to event codes without deleting the original record.

Recurring-event link and action status: _____

Annex E Worked capacity and OEE example

Illustrative arithmetic only. These figures are not IAF performance targets or evidence about an actual plant.

Measure	Example calculation
Shift and planned break	480 minutes scheduled minus 30 minutes break = 450 minutes planned production time.
Takt	450 minutes / 400 units demand = 1.125 minutes per unit (67.5 seconds).
Recorded stop time	50 minutes within the 450-minute window; run time = 400 minutes.
Availability	$400 / 450 = 88.89\%$.
Ideal cycle and count	1.0 minute per unit; 360 total units completed during run time.
Performance	$(1.0 \times 360) / 400 = 90.00\%$.
Quality	342 first-pass good units / 360 total units = 95.00%.
OEE	$0.8889 \times 0.90 \times 0.95 = 76.00\%$.
Cross-check	342 first-pass good units x 1.0 minute / 450 minutes = 76.00%.

In this convention, availability includes recorded stops above the defined threshold; residual speed loss and uncounted short interruptions appear in performance. A loss shall not be counted in both categories. The site shall document how setup and planned maintenance inside the agreed window are treated.

For mixed products, use the sum of each product's approved ideal cycle multiplied by its count. Do not average incompatible rates. If demand, run time, completed count or failure count is zero, apply the defined not-applicable rule and explain the condition.

If 400 conforming units were required, the 342 first-pass units do not meet that demand. OEE and delivery performance answer different questions.

Annex F Implementation and verification plan

Form reference: LMS-F. The sequence below is a deployment framework. Dates are set by the site; every phase ends with evidence-based acceptance.

Phase	Required deliverable / acceptance
1 Scope and baseline	Map lines, variants and shifts; identify critical gaps; validate current quality, safety and downtime data.
2 Critical controls	Release risk assessments, key SOPs, control plans, isolation references and reaction routes. Resolve critical safety and traceability gaps.
3 Resources and people	Authorize operators and specialists; verify maintenance, gauges, spares, material supply and escalation cover.
4 Representative pilot	Trial the method on a defined line and mix. Capture first-pass quality, loss events, operator feedback and abnormal recovery.
5 Controlled rollout	Close pilot findings; issue current instructions; train other shifts; verify local readiness before expansion.
6 Sustain and review	Audit real work, verify recurring-loss actions and reassess capacity. Feed learning into management review and document revision.

Readiness decision

Scope: _____ Phase: _____ Open actions / restrictions: _____

Evidence reviewed: _____

Decision / accountable approver / date: _____

No rollout phase may override a missing safety control or unvalidated critical process. A restricted pilot shall identify the units, operating conditions, authorized people and disposition of trial output.

Annex G IAF document and record interfaces

Document / subject	Application to this manual
IAF-CON-001; IAF-QM-001	Institutional authority, process accountability and quality system oversight.
IAF-GUI-DOC-001	Creation, approval, distribution, revision, retention, archiving and disposal of documents and records.
IAF-MAN-GAA-001	Battery, EV, high-voltage and collaborative assembly controls.
IAF-MAN-OTC-001	Production-system access, digital changes, software loading and cyber recovery.
Membership / accreditation guides	Separate eligibility, evaluation and recognition routes. Use does not itself grant a status.
Whistleblowing / complaints policies	Protected reporting, impartial case handling and escalation of integrity concerns.
Privacy / conflicts / mark policies	Personal information, independent judgment and accurate public claims.

Plant records and retention

The document controller shall register each adopted SOP, control plan, programme baseline, competence record, maintenance order, production genealogy, release, concession and corrective action. Record owner, classification, storage, access, retention trigger and disposal authority. Use the longest applicable legal, customer, product-safety or agreed retention requirement; no universal retention duration is imposed here.

Legal holds and active product investigations suspend disposal for relevant evidence. Preserve original failed results and revisions. Protect personal information and commercially sensitive production records; publish only authorized extracts. Check that archived electronic records remain readable with their interpretation context.