

Tool maintenance: the foundation for availability, quality and unit costs

Tool maintenance encompasses all planned and forward-looking measures to preserve the functionality of tools in manufacturing, such as cutting, pressing, injection moulding and fixture tools. It ensures process stability, dimensional accuracy and adherence to delivery dates, and thus directly influences delivery capability and unit costs. For buyers and supply chain managers, tool maintenance is an essential component of the Total Cost of Ownership analysis and often has to be regulated contractually between tool owner and tool user.

Key facts

- Tool maintenance comprises inspection, maintenance, repair and calibration of production tools according to defined plans.
- In practice, a distinction is frequently made between preventive, predictive and corrective maintenance.
- Maintenance intervals are typically based on stroke counts, cycle counters, operating hours or calendar time.
- In-house and third-party tools require clearly regulated responsibilities, often in so-called tool contracts.
- Key metrics are availability, Mean Time Between Failures and maintenance backlog.
- Without documented maintenance, scrap, unplanned downtime and rework costs increase significantly.

Definition: tool maintenance

Tool maintenance is the totality of all measures to preserve and restore the target condition of production tools. It belongs to the maintenance domain but differs from general plant maintenance through its close coupling to tool life cycles, piece counts and quality characteristics. The term covers planned maintenance as well as fault rectification and functional readjustment.

Distinction from maintenance and calibration

Maintenance is the umbrella term and typically divides into servicing, inspection, repair and improvement. Tool maintenance refers specifically to forming, cutting or joining tools such as injection moulds, pressing tools, stamping dies, casting tools or fixtures. The calibration of measuring and test equipment, by contrast, is a separate process, usually managed in parallel in the test equipment management system.

Relevance for procurement

For procurement, tool maintenance is particularly relevant when tools owned by the buyer are held at a supplier, or vice versa. In both cases, condition, maintenance records and cost responsibility must be contractually defined. Uncertainty on this point frequently leads in practice to disputes over scrap, tool

wear or the question of who pays for spare parts and repairs.

Methods and procedures of tool maintenance

The methodological core is a maintenance-friendly tool life cycle: from design through commissioning, regular operation with documented upkeep, to overhaul or scrapping. The choice of maintenance strategy mix depends on tool value, cycle time, failure risk and production criticality.

Preventive maintenance by schedule

In preventive maintenance, fixed intervals are specified, e.g. after 50,000 cycles for injection moulds or after a defined piece count for stamping tools. Typical measures are cleaning, deburring, lubrication, wear inspection of guide rails, ejectors and cutting inserts, and the advance replacement of wear parts. The advantage is plannability; the disadvantage is possible over-maintenance of tools that were not actually stressed.

Predictive and condition-based maintenance

Condition-based maintenance uses measurement data such as injection pressure, punch force, temperature or cycle time drift to detect wear early. Modern control systems already deliver this data as standard; sensors and tool telemetry supplement it for critical tools. In practice, one often starts with the three to five most valuable or most tightly scheduled tools and expands monitoring step by step.

Corrective maintenance and emergency processes

Corrective maintenance rectifies faults after they occur. Since unforeseen tool failures directly jeopardise delivery capability, an escalation path should additionally be defined, for example via a procurement emergency team that coordinates repairers, spare parts availability and alternative production at short notice in the event of a critical tool defect. A documented failure analysis prevents the same cause of failure from recurring.

Organisation: responsibility for own and third-party tools

The tool stock in the supplier industry is frequently mixed: own in-house tools, customer tools stored at the supplier, and loaned or rented tools. For each category, ownership, maintenance obligation, cost sharing and insurance must be clearly regulated.

Tool contracts and documentation

Tool contracts typically regulate ownership, labelling, storage, maintenance obligation, rights of use for third parties, insured value and return. The tool passport includes design data, change statuses, maintenance history, spare parts list and inspection records. Without this documentation, supplier changes or disputes over tool condition are difficult to resolve objectively.

Supplier selection and audits

When selecting suppliers and in supplier audits, maintenance competence should be examined: Does a maintenance plan exist per tool? Are intervals complied with and demonstrably documented? How are tool breakages and the spare parts situation handled? These criteria can be integrated into supplier classification and the Supplier Segmentation Matrix, and strategically important tool suppliers can be given corresponding preferential support.

Tool logistics and availability

Such diverse tools must be in the right place at the right time: for changeover operations, for overhaul or for tool changes. A stock issue analysis at spare part and tool component level shows which wear parts should be held. In addition, a replenishment process for standard wear parts ensures that consumables such as cutting inserts, springs or seals are reordered automatically.

Key KPIs for steering tool maintenance

Tool maintenance can be steered with a few, practice-oriented metrics. What is decisive is that supplier and buyer use the same definitions and jointly assess the values in regular reviews.

Availability and failure metrics

Tool availability is typically managed with a target value of over 98 per cent. In addition, Mean Time Between Failures (MTBF) and Mean Time To Repair (MTTR) describe how reliably and how quickly a tool can be restored. Rising micro-stoppages or growing rework rates are often early indicators of overdue overhauls.

Costs and maintenance status

Maintenance and repair costs per 1,000 parts or per year make tool costs transparent in the unit price and can be assessed via functional cost accounting. A maintenance index or maintenance status per tool (green/yellow/red) shows whether overhauls are on schedule. Tools in the red zone should be blocked for new projects or higher-volume orders.

Integration into procurement metrics

Tool failures feed through into adherence to delivery dates and procurement metrics: a sluggish expedite rate for spare parts, repeated price deviations from the purchase order for emergency repairs, or frequent pilot deliveries after tool changes are signals of structural weaknesses. These connections make tool maintenance an early-warning system relevant to procurement.

Risks, controls and contractual safeguards

The greatest risks are undetected wear, missing documentation and unclear cost responsibility. Controls therefore combine technical inspections with contractual and procedural safeguards.

Incoming goods and first inspection

After tool overhaul or tool change, incoming goods inspection is particularly important. An incoming inspection plan defines which characteristics are checked with which sample size, for example during first article inspection after repair. Renewed sample deliveries and release measurements prevent an apparently intact tool from systematically producing scrap.

Contract and liability issues

Tool contracts should regulate who bears the repair costs in the event of wear, operating errors or force majeure, and how the tool value is assessed in the event of total loss. Rights of use (may the supplier use the tool for third parties?), follow-on production rights and storage remuneration also typically belong in the contract. Legal details vary depending on the legal system and contract design and should be examined case by case.

Evidence and audit trail

Maintenance records must be documented in an audit-proof manner, both for internal audits and for customer requirements, for example in the automotive or medical technology industry. A contract repository helps to store tool contracts, approvals and maintenance agreements centrally and to have them to hand during supplier changes or contract renewals.

Current developments and digitalisation

Tool maintenance is becoming digital: tool management systems, MES integration and sensor technology enable a data situation that was not accessible to mid-sized companies a few years ago. At the same time, cost pressure is increasing to plan wear more precisely rather than blanket over-maintenance.

Digital tool management

Digital tool passports link design data, cycle counters, maintenance history and quality data. In combination with cycle counting approaches for tool stocks and spare parts, an overview of thousands of items is maintained. Inventory counting methods from warehouse logistics, such as perpetual inventory, can also be transferred to tool warehouses.

Procurement of maintenance services and spare parts

Standardised wear parts and simple maintenance services can increasingly be procured via electronic channels, for example via catalogue buying with pre-agreed prices. For complex overhauls, by contrast, the individual price request in a fast-track process remains customary, since scope and scope changes must be assessed on a tool-specific basis. Suppliers' ancillary offers, such as offered maintenance packages, also deserve their own assessment.

Sustainability and service life extension

Overhauled instead of new tools save material and costs; remanufacturing of moulds and tool components is gaining importance. Not least due to regulatory requirements such as supply chain legislation, there is also heightened interest in the origin of tool steels and working practices at repair partners.

Typical metrics

Tool availability: > 98 %

Typical target value for critical tools in series production

MTBF (Mean Time Between Failures): tool-specific

Assess trend over time; absolute values depend heavily on tool type

MTTR (Mean Time To Repair): < 24 h (critical tools)

In practice often defined as a benchmark for expedited repair

Maintenance interval compliance: > 95 %

Proportion of planned maintenance completed on time

Maintenance cost per 1,000 parts: tool-specific

Normalise via functional cost accounting for comparability

Practical example

A mid-sized plastics injection moulding supplier delivers housing parts made from customer-owned tools to an automotive supplier. After repeated short stoppages and rising rework costs, a joint analysis revealed that maintenance intervals had been defined on a calendar basis instead of a stroke-count basis and that there was no tool passport with wear history.

- Introduction of a digital tool passport with cycle counter and maintenance history for all customer-owned tools
- Switch to condition-based maintenance for the five most critical moulds with drift monitoring of cycle times
- Agreement on maintenance intervals, cost sharing and evidence obligations in a supplemented tool contract
- Establishment of a minimum stock of wear parts with automatic replenishment for standard components

Conclusion

Tool maintenance is far more than a maintenance task on the margins of manufacturing; it determines availability, quality and unit costs, and thus the competitiveness of supplier relationships. For procurement, four points are worth focusing on: clear contractual responsibilities, documented maintenance plans, joint metrics with suppliers, and a prepared spare parts and emergency strategy. Those who steer tool maintenance systematically reduce unplanned downtime and preserve delivery capability even under tight cycle times. Those who neglect it pay for it later several times over through scrap, emergency repairs and time pressure.

Frequently asked questions

What is meant by tool maintenance?

Tool maintenance refers to all planned measures for preserving the functionality of production tools such as pressing, injection moulding, cutting and fixture tools. It includes inspection, cleaning, lubrication, wear-part replacement and repair at fixed intervals or based on condition data. The goal is high tool availability and consistent product quality.

How often should tools be maintained?

The interval depends on tool type, load and criticality. Common rules of thumb are defined stroke or piece counts, e.g. cycle counters on injection moulding tools, or calendar intervals for rarely used tools. In practice, the combination of a base interval and condition-based adjustment has proven effective.

Who is responsible for maintaining customer-owned tools at the supplier?

This is a matter of contract. Frequently the supplier bears the operational maintenance obligation, while the tool owner bears costs above defined thresholds or major overhauls. Tool contracts should clearly regulate ownership, maintenance intervals, evidence obligations, insurance and rules of conduct in the event of total loss.

What does the maintenance of an injection moulding tool typically cost?

General figures are difficult to give because tool size, complexity and moulding material vary widely. In practice, maintenance costs are often assessed as a percentage of tool acquisition cost per year or as

cost per 1,000 shots. What matters is transparency via a functional cost accounting rather than a flat rate in the unit price.

Which metrics are relevant for tool maintenance?

Key metrics are tool availability, Mean Time Between Failures, Mean Time To Repair, maintenance interval compliance and maintenance cost per 1,000 parts. In addition, rework rate and scrap after maintenance events provide indications of maintenance quality. A uniform definition between buyer and supplier is important.

What belongs in a tool passport?

Typically design and change data, tool ID and labelling, spare parts list, maintenance plan and maintenance history, inspection records as well as information on ownership and storage location. The tool passport is the basis for overhaul decisions, audits and a possible supplier change.