M&Q ENGINEERING SOLUTIONS

Abstract

This document identifies 90 engineering tools and methodologies within the M&Q Engineering Solutions portfolio. These capabilities are categorized into nine technical domains: Systems & Validation, Supplier Quality Engineering (SQE), Supply Chain Engineering (SCE), Reliability & Safety Engineering (RSE), R&D • Design for Quality (DFQ), Metrology & Calibration, Manufacturing Management, Lean Six Sigma • Black Belt (LSSBB), and ESG & Compliance.
The content defines specific modules for requirements quality, risk assessment, supply chain optimization, and regulatory adherence.

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☑ MANUFACTURING TOOLS

1. Machine ROI – Capital Justification

Calculates payback period and ROI from machine investment vs expected annual savings.

2. COPQ Executive Dashboard

Rolls up the financial impact of scrap, rework, and warranty into a unified cost-of-poor-quality model.

3. Labor Efficiency Variance Tracker

Compares planned vs actual labor hours to compute labor variance and efficiency impact.

4. Energy Cost per Part

Determines per-unit energy cost based on wattage, cycle time, and electricity rate.

5. Scrap Financial Impact

Computes cost of scrap and overall scrap-rate to highlight waste contribution.

6. Shift Handover Gap Analysis

Calculates lost production caused by downtime during shift transitions.

7. Training Matrix Gap Analysis

Identifies gaps between current staff skill levels and required competency targets.

8. 3D Warehouse Utilization

Calculates warehouse volumetric utilization based on storage geometry and facility dimensions.

9. Inventory Turnover

Computes turnover ratio and days-to-turn from COGS vs inventory values.

10. Production What-If Simulator

Simulates changes in speed and scrap rate to estimate profit increase or loss.

☑ ESG TOOLS

11. Scope 1 Emissions Audit

Calculates CO_2e emissions from fuels using regulatory emission factors.

12. Scope 2 Dual-Method Audit

Compares location-based vs market-based electricity emissions.

13. Scope 3 Value-Chain Estimator

Estimates upstream/downstream emissions using spend-based or mass-distance models.

14. Product LCA Estimator

Calculates cradle-to-gate environmental impact from materials, energy, and transport.

15. Waste Stream Classifier

Computes waste emissions and diversion rate (recycled/re-used vs landfilled).

16. Water Stewardship Module

Calculates impact using Water Scarcity Index and basin-level stress modelling.

17. Packaging Impact Calculator

Computes packaging carbon footprint and circularity score.

18. Regulatory Compliance Engine

Checks environmental test values against regulated thresholds.

19. CBAM Duty Calculator

Computes carbon cost for imports based on intensity × ETS price.

20. ISO 14001 Readiness Checker

Scores clause compliance and identifies environmental management gaps.

☑ LSSBB TOOLS

21. Universal Analyzer

Computes capability indices (Cpk, Cpu, Cpl) for measurements or defect data.

22. Line Balancer Pro

Evaluates takt time, detects bottlenecks, and computes line efficiency.

23. M&Q Yield Engine

Computes step yield, RTY, DPMO, and sigma level for multistep processes.

24. OEE Performance Engine

Calculates Availability, Performance, Quality, and overall OEE.

25. Sample Size Validator

Computes correct sample size for hypothesis testing using Z-based equations.

26. Box-Cox Transformer

Normalizes data using lambda-based transformation for capability analysis.

27. SMED ROI Engine

Calculates financial gain from setup-time reduction (SMED projects).

28. Kanban Bin Engine

Computes number of Kanban bins required based on demand, lead time, and safety stock.

29. VA Ratio Analyzer (TIMWOODS)

Calculates value-added percentage vs total process time.

30. Pareto Analyzer

Sorts defects/occurrences and plots cumulative 80/20 distribution.

☑ RSE TOOLS

31. FTA Vector Engine

Builds fault trees, propagates failure probabilities, and extracts minimal cut sets.

32. RBD Elite Pro

Models system reliability using reliability block diagrams and minimal path sets.

33. Availability Engine v4.5

Computes system availability, MTBF, MTTR, and equivalent failure rates.

34. Mission Reliability Inspector

Models multi-phase mission reliability with k-out-of-n redundancy.

35. Spares Optimization Engine

Uses Poisson stock modeling to compute required spares and service levels.

36. AMSAA Reliability Growth Tracker

Computes Crow-AMSAA parameters and reliability growth curves.

37. Hazard & Density Engine

Calculates exponential and Erlang reliability, hazard, and density functions.

38. SIL/PL Technical Compliance Engine

Computes PFH, DCavg, MTTFd and assigns SIL/PL ratings.

39. FMEDA Diagnostic Coverage Tool

Models FIT modes and computes SFF, DC, and safe/dangerous splits.

40. FRACAS Incident Manager

Tracks incidents through closure with MTTR, closure-rate, and audit logs.

☑ METROLOGY TOOLS

41. Gage Capability & Uncertainty

Computes measurement expanded uncertainty from repeatability, resolution, and calibration inputs.

42. Guard Banding Suite

Adjusts acceptance limits based on measurement uncertainty.

43. Gage R&R (Auto-Spec)

Computes EV, %GRR, and uses ISO-grade tolerances to determine acceptability.

44. Calibration Interval Optimizer

Extends or shortens calibration intervals based on drift-to-tolerance ratio.

45. Thermal Expansion Offset Tool

Adjusts measured dimension to 20°C using thermal expansion.

46. Inter-Lab En Score

Computes En score to determine agreement between labs.

47. Resolution Uncertainty Calculator

Computes uncertainty due to instrument resolution.

48. Torque Tolerance Tool

Calculates allowable torque range based on %FS or %Reading rules.

49. Air Buoyancy Correction

Corrects mass measurement for buoyancy effects.

50. Rule of Ten: Tool Selector

Computes TUR ratio and evaluates suitability of measurement equipment.

☑ R&D TOOLS

51. Tolerance Stack Analyzer

Computes worst-case and RSS assembly stack-up.

52. Monte Carlo Tolerance Simulator

Simulates distributions and interference likelihood via Monte-Carlo sampling.

53. Weibull Life Analyzer

Computes Weibull β, η, and MTTF from failure life data.

54. MTBF & System Reliability Tool

Computes MTBF, λ, and survival probability R(t).

55. Arrhenius ALT Analyzer

Computes acceleration factor and required test time using Arrhenius model.

56. Full-Scale FMEA Tool

Generates AP ranking and risk-bubble visualization.

57. GD&T MMC Calculator

Computes MMC bonus, total tolerance, and virtual condition.

58. HALT/HASS Stress Planner

Creates stress ramp plan for rapid failure discovery.

59. Material Safety Factor Auditor

Computes FoS based on UTS, method factors, and applied stress.

60. DFA Design Auditor

Computes total assembly time and DFA efficiency percentage.

☑ SQE TOOLS

61. ISO 2859-1 Sampling Tool

Generates sampling code letters, sample sizes, and Ac/Re values.

62. AQL vs LTPD Mapper

Plots OC curves using Poisson approximation.

63. C=0 Calculator

Computes sample sizes for zero-acceptance sampling.

64. Supplier Scorecard

Weighted score for quality, delivery, and audit.

65. PPM → Sigma Converter

Converts PPM to sigma level (with optional 1.5σ shift).

66. Carbon Footprint Tool

Computes shipping footprint from weight × distance × EF.

67. SCAR Tracker

Tracks supplier corrective action stages over time.

68. Counterfeit Risk Calculator

Risk score = Source × Criticality × Inspection.

69. Inter-Rater Kappa

Computes Cohen’s Kappa for attribute agreement.

70. Duty & Tariff Tool

Computes duty-impact based on CIF value (currently flagged incorrect in test results).

☑ SCE TOOLS

71. Lead-Time & Service Level Optimizer

Computes safety stock & reorder point under variable lead time.

72. Safety Stock Engine

Computes service-level-based safety stock and holding cost.

73. Incoterms Cost Split Analyzer

Allocates freight and cargo cost by Incoterm rules.

74. Supplier Capacity & Ramp Estimator

Computes capacity, utilization, and supplier phase (initial/growth/peak/surge).

75. Currency Exposure Impact Simulator

Calculates cost variance under exchange-rate scenarios.

76. MOQ / EOQ Optimizer

Handles EOQ, MOQ penalties, and cost-efficiency.

77. Multi-Sourcing Decision Matrix

Weighted risk scoring and price-vs-risk quadrant mapping.

78. Network Transit & Buffer Planner

Computes lead-time with buffers and visual timeline.

79. Supplier Concentration Index (HHI)

Computes HHI and concentration risk category.

80. Purchase Price Variance Dashboard

Computes PPV and portfolio impact.

☑ SYSTEMS TOOLS

81. Requirements Quality Checker

Scores requirement clarity (SHALL, verifiable, measurable, active voice).

82. Traceability Matrix Builder

Maps requirements to verification tests and detects orphans.

83. V&V Intelligence Engine

Calculates weighted maturity, stability, and pass-rate metrics.

84. Acceptance Criteria Analyzer

Validates clarity of acceptance criteria (IF-THEN, units, ranges).

85. TPM Performance Tracker

Tracks limit margins and trends in MAX/MIN/BAND monitoring modes.

86. Risk-Based Test Prioritizer

Ranks tests by Probability × Impact score.

87. FFBD Tool

Creates functional flow block diagrams with logic gates and hierarchy.

88. Requirement Complexity Scorer

Classifies requirement complexity (Low/Mod/Critical).

89. Safety Traceability Engine

Computes hazard RPN, ASIL class, and linkage state.

90. V&V Scheduler

Builds ordered V&V schedule, validates milestone logic, and detects conflicts.