

### Algoryx Risk Mangement Matrix (RMM)

No.	Risk Factor	Risk Factor Root Cause	Risk Factor Sub-causes	Immediate Consequences	Follow-on Consequences	Quality Impact	Schedule Impact	Cost Impact	Algoryx Risk Mitigation & Reduction
1.	Mold	Mold designers and fabricators deliver "steel-safe" molds	Marginal CAE modeling results. Conservatism.	Multiple mold and press tuning cycles.	Increased costs. Schedule delays. Pressure to put the mold into production.	Low	High	High	One and only one mold tuning cycle using the Offset Table
2.	Mold	Incremental mold tuning is used to "creep up" on final mold dimensions	Steel is hard to add. Conservatism. Linear NPD processes. Cause & effect complexities.	Multiple mold and press tuning cycles.	Increased costs. Schedule delays. Pressure to put the mold into production.	Low	High	High	One and only one mold tuning cycle using the Offset Table
3.	Mold	Mold tuning is dependent on press settings	Cause & effect methods. Linear NPD processes.	Multiple mold tuning cycles.	Lower mold quality. Lower part quality. Pressure to put the mold into production.	High	High	High	One and only one mold tuning cycle using the Offset Table
4.	Mold and Press	Cavity-to-cavity environmental differences	Cavity-to-cavity cooling and heating system differences.	Multiple mold, press and tolerance tuning cycles.	Increased costs. Schedule delays. Pressure to put the mold into production.	High	High	High	One and only one mold tuning cycle using the Offset Table
5.	Mold and Press	Cavity-to-cavity flow path differences	Different cavity-to-cavity flow path lengths and configurations.	Multiple mold, press and tolerance tuning cycles.	Increased costs. Schedule delays. Pressure to put the mold into production.	High	High	High	One and only one mold tuning cycle using the Offset Table
6.	Mold	Cavity-to-cavity dimensional differences	Cavity-to-cavity mold manufacturing variation.	Multiple mold, press and tolerance tuning cycles.	Increased costs. Schedule delays. Narrow process window. Pressure to compromise quality.	Low to Medium	Medium	Medium	One and only one mold tuning cycle using the Offset Table
7.	Mold	"Good Enough" mold tuning	Cause & effect complexities. DOE of limited help. Linear NPD processes.	Stop tuning the mold when can make conforming parts.	Lower mold quality. Lower part quality. Narrow process window.	Medium	Low	Low	Do optimal mold tuning using offsets that are independent from press settings
8.	Mold	Inadequate mold capability to handle normal press variation during production	Molds are delivered without proof they can handle normal press variation.	Multiple mold, press and tolerance tuning cycles.	Increased costs. Schedule delays. Restricted process window. Pressure to compromise quality.	High	High	High	Deliver proof along with the mold that Opk meets requirements
9.	Mold Wear	Mold wear during production	Tendency to ignore mold wear.	Lower quality parts. Possible defective parts.	Degraded system-level performance. Possible shut down of automated assembly.	High	Low	Low	Use changes in the OR to proactively schedule mold preventative maintenance

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10.	Blocked Mold Cavities	Running with blocked mold cavities during production	One or more mold cavities blocked because of dimensional non-compliance.	Lower quality parts. Possible defective parts.	Degraded system-level performance. Possible shut down of automated assembly.	High	Low	Low	Compute new Operating Range and Operating Target
11.	Part Design Tolerances	Tolerance relaxations dependent on press settings	Cause & effect methods. Linear NPD processes.	Multiple tolerance relaxation cycles.	Pressure to compromise tolerances. Degraded system-level performance.	High	Low	Medium	One and only one tolerance relaxation tuning cycle using the Tolerance Tables
12.	Part Design GDT	Improper GDT	Poor GDT practices.	Excessive dimensional variation.	Additional mold tuning cycles. Additional tolerance relaxations. Hunt for min. var. press settings. Change measurement system.	Low	High	High	Identify improper GDT. One and only one GDT tuning cycle
13.	Part Physical Design	Inadequate Part Design	Don't use CAE. Poor CAE modeling results.	Warp. Sink.	Additional mold, press and tolerance tuning cycles. Degraded quality.	High	High	High	Use two CM methods to reduce warp and sink. CM is not a CAE program.
14.	Metrology	Incapable measurement system	Poor metrology practices.	Excessive dimensional variation.	Additional mold tuning cycles. Additional tolerance relaxations. Hunt for min. var. press settings. Change measurement system.	Low	Medium	Medium	Identify incapable metrology. One and only one metrology tuning cycle
15.	Metrology	Measurement error	Human error. Machine error.	Excessive dimensional variation.	Additional SPC and Cpk analysis. Additional mold tuning cycles. Additional tolerance relaxations. Additional press tuning cycles. Change measurement system.	Low	Medium	Medium	Identify bad data points. Eliminate bad data points
16.	Metrology	Data recording error	Human error. Machine error.	Excessive dimensional variation.	Additional SPC and Cpk analysis. Additional mold tuning cycles. Additional tolerance relaxations. Additional press tuning cycles. Change measurement system.	Low	Medium	Medium	Identify bad data points. Eliminate bad data points
17.	Press Settings	Press settings driven by changes to design targets, design tolerances, GDT, the mold, and metrology	Little or no control on the remaining 12-15 knobs on the press during	The process engineer iterates on press settings to find something that works.	Additional press tuning cycles.	Low	Medium	Medium	One and only one press tuning cycle
18.	Press Settings	Non-optimum press settings	Cause & effect methods. Pressure to meet the delivery schedule.	Lower Cpk. Degraded cosmetics. Unnecessarily long cycle times.	Pressure to start production. Degraded system-level performance.	Medium	High	High	Identify optimum press settings using the Operating Target
19.	Press Settings	Constrain only the 3 largest knobs on the press during production	Qualification procedure using 3-factor DOE. Remaining 12-15 knobs vary during production.	Monitoring 3 press settings with possible inadequate process control.	Lower quality parts. Degraded system-level performance. Possible shut down of automated assembly.	High	Low	Low	Monitor the Predictor Dimension against the Operating Range

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20.	Design	Large number of critical design dimensions	Inherent in design.	Difficult to qualify the mold. Buries critical SPC and Cpk data.	Increased costs. Schedule delays. Pressure to compromise.	Medium	High	High	Monitor the Predictor Dimension against the Operating Range
21.	Mold	High cavitation mold	Production efficiency.	Difficult to qualify the mold. Buries critical SPC and Cpk data.	Increased costs. Schedule delays. Pressure to compromise.	Medium	High	High	Monitor the Predictor Dimension against the Operating Range
22.	NPD Mistakes	Human error	Schedule, cost and technical pressures	Have to redo work to undo mistakes	Increased costs. Schedule delays. Pressure to compromise.	High	High	High	Use CM's simulation capability to simulate changes before actually doing so
23.	Change the Press	Change the press	Production decision.	Must requalify the mold.	Increased costs. Schedule delays. Pressure to compromise.	High	High	High	Operating Range and Operating Target transfer with the mold
24.	Change the molder (supplier)	Change the molder (supplier)	Customer decision.	Must learn new press settings. May have to requalify the mold.	Increased costs. Schedule delays. Pressure to compromise.	Medium	High	High	Operating Range and Operating Target transfer with the mold
25.	Material Change	Material changes	Tendency to ignore. Lot-to-lot variation. New material supplier. Obsolete material.	Lower quality. Defective parts.	Degraded system-level performance. Shut down automated assembly .	High	Medium	Low	Recalculate the Operating Range. Recalculate the Operating Target
26.	Production Inspection	Inadequate in-process measurement	In-process measurement is decreased to lower production costs.	Fewer design dimensions are measured. The sampling frequency is decreased.	Higher risk of defective parts.	High	Low	Low	Monitor the Predictor Dimension against the Operating Range
27.	Production Inspection	Monitoring the last dimension to fill during production	Using outdated technology.	Possible bad parts. Lower part quality.	Can degrade system performance. Can shut down automated assembly.	High	High	High	Monitor the Predictor Dimension against the Operating Range
28.	Production Inspection	Monitoring the dimension most sensitive to process changes during production	Using outdated technology.	Possible bad parts. Lower part quality.	Can degrade system performance. Possible shut down of automated assembly.	High	High	High	Monitor the Predictor Dimension against the Operating Range
29.	Production Inspection	Monitoring the dimension most critical to function during production	Using outdated technology.	Possible bad parts. Lower part quality.	Can degrade system performance. Possible shut down of automated assembly.	High	High	High	Monitor the Predictor Dimension against the Operating Range
30.	Press Settings	Press running outside of the process window	Pressure to reduce cycle time. Inadequate press control. Operator inattention.	Possible bad parts. Lower part quality.	Can degrade system performance. Possible shut down of automated assembly.	High	High	High	Use the correlation charts to identify non-standard data patterns

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31.	Culture	Decisions not based on data	Trial-and-error. Iteration. Guesswork. Outdated technology. Linear NPD processes.	Multiple mold, press, GDT, measurement system, and tolerance tuning cycles.	Higher cost. Delayed schedule.	High	High	High	CM enables data-based decision-making
32.	Culture	Different languages	Cultural reality.	Miscommunication due to language differences	Potential for major mistakes.	High	High	High	Use the CM charts and tables to avoid communication problems
33.	Culture	Different attitudes towards risk	Cultural reality.	Different decisions based on different attitudes towards risk.	Potential for major decision outcomes.	High	High	High	CM establishes a unified framework for making risky decisions
34.	Geography	Different time zones	Geographic reality.	Reduced communication. Untimely communication. Miscommunication.	Potential for major mistakes.	High	High	High	Use the CM charts and tables to avoid communication problems
35.	Pressure Sensors	Use pressure sensors to accept/reject shots	Not buying pressure vs. time profiles. No science behind the tolerance bands.	Higher risk of accepting bad parts. Higher risk of rejecting good parts.	Can lower quality. Can degrade system performance. Possible shut down of automated assembly.	Medium	High	High	Use the Upper and Lower Operating Limits to make the accept/reject decision
36.	Pressure Sensors	Use pressure sensors to control the press	Not buying pressure vs. time profiles.	A non-optimum solution.	Lower quality.	Medium	High	High	Use the Predictor Dimension deviation from the Operating Target as the control signal
37.	Supplier Evaluation	Evaluating molding supplier technical performance	No scientific means to rank the molder's technical performance.	Evaluate molding suppliers primarily on cost and schedule performance.	Lower quality.	High	High	High	Grade molders using science-based and quantifiable Opk
38.	Assembly Performance	Tolerance stackup	Tolerance stackup degrades assembly performance.	Poor assembly performance.	May require redesign.	High	High	High	Transfer excess process capability to mating part with low Opk
39.	Schedule Delays	Schedule delays	All the above.	Delayed product introduction.	Pressure to compromise. Lower quality. Lost sales. Lost market share.	Medium	High	High	One-step tuning cycles. Faster, leaner qualification
40.	Cost Overruns	Cost overruns	All the above including schedule delays.	Costs exceed the development budget.	Pressure to compromise. Higher costs. Lower profits.	Medium	Low	High	Eliminate extra tuning cycles, redundant qualification work and schedule delays