

USING SMARTER TOOL MANAGEMENT FEATURES IN MAKINO A-51NX MILLS

Manufacturing Mastery Since 1924

Central Screw Products Company (CSP) is a 3rd generation machining company, founded in 1924.

CSP leverages the latest in robotics and automation technology to achieve one of the machining industry's most efficient engineering to production ratios. The result is mastery and control of the manufacturing process, maximum customer value, and unparalleled quality.

We machine Titanium, Inconel, and other hard materials to precise tolerances for the most demanding industries such as defense, medical, aerospace, and automotive.

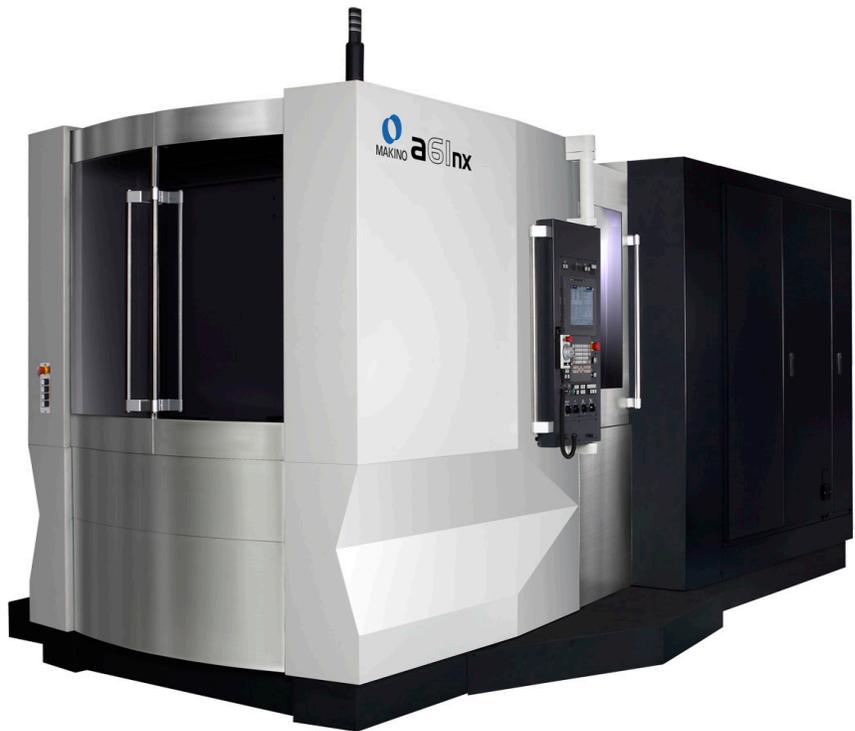
Our global supply chain provides a reliable single source for diverse secondary operations and value added logistics.

CSP is ISO 9001:2015 Certified, AS 9100 Compliant, ITAR Registered, and a proud recipient of a number of industry and OEM supplier quality awards.

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The Makino brand is universally renowned for high-power, high-speed precision equipment. However, all of this capability comes to a halt without smart tool management.

Central Screw Products use our Makinos to machine demanding superalloys like Inconel 718. Using the tool management features built into our Makino, in conjunction with Haimer holders and OSG drills, our OEE (Overall Equipment Effectiveness) has nearly doubled! This increased uptime in our spindles makes DGW a leader in superalloy machining.

The Makino A51NX provides a sophisticated array of tool management features. For example, we can monitor and replace tools based on time, the number of workpieces, or even active parameters from spindle load monitoring or external broken tool detection.

ADVANCED TOOL MANAGEMENT

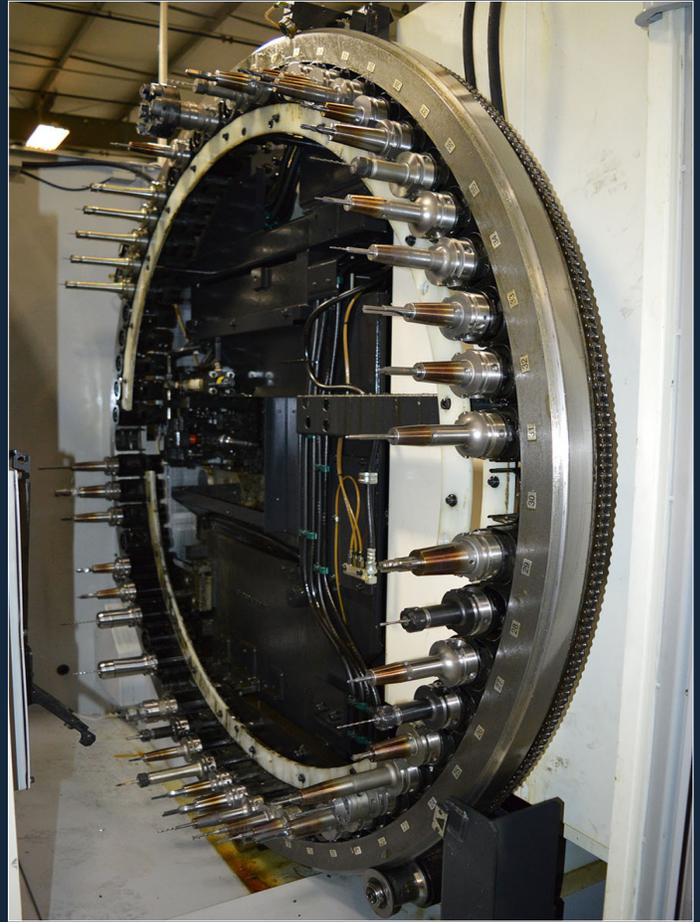
At CSP we can monitor all of our active tools in minutes. Many of our standardized tools apply to all our turning and milling cells, so effective management permits a partially used tool to create value elsewhere.

The single greatest value we have created with Makino tool management is with the direct spare tool selection mode. This function enables us to install as many duplicate tools as desired, ascribe tool life to each, and let the Makino actively switch out tools with direct replacements in different pot numbers (physical tool magazine position) automatically, with no manual changes by the operator.

We have demonstrated that even a single duplicate tool added to the cell can improve spindle utilization by up to 40%.

This process creates significant cost savings for our customers and increases shop capacity and efficiency without increased labor!

These smart tool management features are essential for any operation considering automation. By using direct spare tool selection mode, CSP puts our Makinos in "lights-out" mode, leaving them to machine up to two full pallets completely unattended with no risk of broken tools!



To fully leverage the potential of our Makinos, CSP underwent a period of intense standardization, identifying best practices as well as default toolsets to be kept in every magazine.



CSP chose Haimer holders for the superiority and durability of the power-shrink system. Power-shrink keeps runout to an absolute minimum with even our smallest drills and creates perfect seals for high-pressure through-spindle coolant.

The Haimer Shrink system has proven to be a game changer to our capabilities with exotic superalloys like Titanium and Inconel. For example, standardized tools and holders mean that a through-coolant .064 drill achieves precisely the same life-cycle from one machine to the next, giving us ultimate process control for our cost.

OPTIMIZING TOOL PERFORMANCE

Standardizing tools created lasting value with our tool management, particularly in Inconel 718.

OSG indexable drills were used to create flat bottoms for staggered drilling operations that maximized our MRR (Material Removal Rate.) However, these tools typically lasted for only 6-9 minutes in the cut. To accomplish our optimization goals, CSP purchased three or more of every OSG drill body and applied the direct spare tool select mode on the Makino to pull each tool as needed to maintain optimal production.



This process allows us to proactively change the inserts on two drill bodies once the third is in use, fully optimizing the large tool magazine of the Makino. Our Pro5 control even allowed us to see and change the order of tools used in the direct selection method! Where tool changes are unavoidable, it was gratifying to witness our operators replacing tools while the machine remained 100% effective and in-the-cut using direct spare tool selection.

Warnings and alarms are an essential distinction that allows for flexibility in our system. For example, we may set a tool to expire after 6 minutes, but what happens if it is only at 5.99 minutes when pulled from the magazine? The Makino only evaluates tool alarm status when it sees a "T" command. As long as the tool is not in warning status it is selected.

As tool use time accrues, the tool warning may be tripped. At CSP we opt for this to result in a warning and continue machining. Once finished, the tool is placed back in the magazine and won't be selected again until the warning signal is cleared.

Our tool life alarms are the "hard stops." If a tool enters its "alarm state" during machining, it creates an alarm that stops the current motion and ceases machining. With complex tombstones it is essential to understand the total tool usage time for any specific cell from the magazine. The difference from alarm status to warning status must exceed this to maximize uptime and give the operator sufficient time to perform a tool change using the tool magazine access door. In this way, we almost never see a tool alarm red-light. Instead, our team is responding proactively to the tool warnings and making replacements.

How does CSP manage this system when so much of the detail can only be derived from actual machine operation? By using dedicated libraries of data on past jobs and tooling applications, and also with machine simulation tools like Vericut. By simulating entire tombstones and programs in Vericut, we can see exactly how long each tool is actively cutting, and tombstone cycle times. From here we can plan effectively and determine how many parts can be fabricated from all tombstones in a 24-hour period, then choose our duplicate tools accordingly to minimize downtime due to tool changes. It is not uncommon in our shop to see our Makinos changing tools only once per day!

CONCLUSION: ADVANCED TOOLS PRODUCE SUPERIOR RESULTS

Using the most advanced machine tools and technology sets CSP apart from the manufacturing crowd. Our engineering team continually analyzes new methods to apply to our tools and technology to fully maximize the potential of our operations.

Producing Inconel 718 components for a demanding suppressor OEM program proved fertile ground for optimization. Over an entire production run, we dramatically reduced our tooling costs from over \$200/hour to just \$28, while increasing MRR, resulting in increased production output of 360%!



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