

# Tool-X<sup>®</sup>

Tech Data Sheet 105

Horizontal CNC Milling

**What is Tool-X?** A nanofluid additive for metalworking fluids that contains trillions of carbon-based nano-onions in solution. When used in conjunction with metalworking fluids, fluid saturated nano-onions flow between a tool and workpiece to change the characteristics of the metal working action. The result is reduced vibration, reduced machine loading and increased heat transfer away from the metal-to-metal work zone.

**Application:** Horizontal CNC machining of 4140 steel with a 1/2" solid carbide ProMax end mill in a high-production environment.

**Problem:** Insufficient dimensional quality and surface finish for one of several tools in a CNC machining operation.

**Situation:** Quality issues (dimensional and finish) were restricted to three milled surfaces of a cube-shaped geometry.

**Evaluation Process:** The machine's coolant sump was cleaned out and refilled with fresh water-based coolant installed at the prescribed concentration and pH prior to testing. To establish a baseline representing normal production, x-axis and z-axis surfaces of the defined geometry were machined. Spindle loads, dimensions and surface finishes (RMS) were measured for each of the surfaces. After establishing a baseline, Tool-X nanofluid was added to the coolant, and the machining process was repeated.

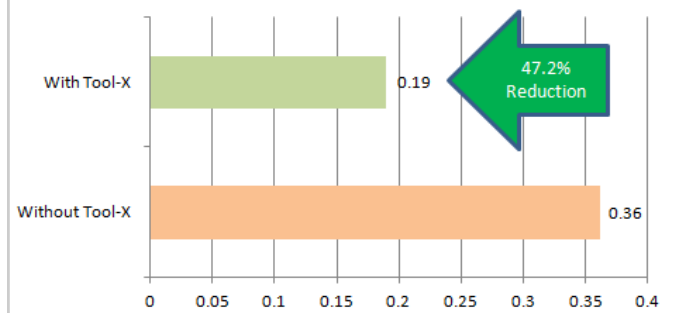
**Solution:** The addition of Tool-X to existing coolant allowed for reduced cutting forces and realization of the required quality.

**Results:** Spindle loads were reduced by up to 75.1% during machining. Dimensional variation was reduced by 47.2%, surface finish (RMS) variations were reduced by 14.44% and 35.70% for the x-axis and z-axis, respectively.

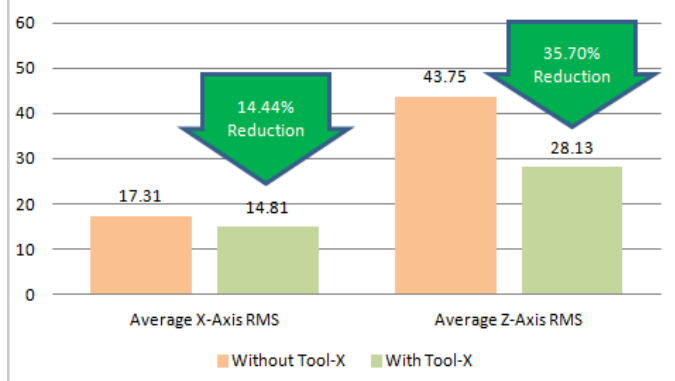
**Outcome:** The addition of Tool-X became the standard for this machining operation with improved performance realized for all tools used in the machine.

**What is the role of metalworking fluids in machining?** For many manufacturing applications, metalworking fluids are necessary but insufficient. The role of these fluids is to create an environment where tools can be proficiently used to change the shape of materials as efficiently and effectively as possible. To achieve this objective, metalworking fluids must counteract common failure modes by reducing heat, adhesion, pressure and wear while providing lubricity under extreme temperatures and pressures associated with metalworking. TOOL-X nanofluid technology enables metalworking fluids in such a manner as to meet these objectives and attain new levels of performance. To learn more, visit [www.TOOL-X.net](http://www.TOOL-X.net).

**Average Standard Deviation for Measured Dimensions**



**Analysis of Surface Finish (RMS)**



Visit [www.TOOL-X.net](http://www.TOOL-X.net) to learn more.