Department of Mechanical Engineering

Standard Operating Procedure

CNC Milling

September 4, 2025

Authors: Astro Bornshteyn, Adriel Diaz, Maliha Hoque, David Malvaez, Aksha Mia, Youssef Nafea, David Orellana, Fairuz Shrabon, Armando Torres

STANDARD OPERATION PROCEDURE

Purpose:	The purpose of this CNC milling SOP is to provide clear instructions for safely and efficiently operating the machine. It exists to ensure consistent part quality, reduce errors, and protect both the operator and equipment.
Scope:	This SOP applies to all personnel involved in CNC milling operations, including machine operators, programmers, supervisors, inspectors, and maintenance staff. This SOP should be used at the CNC milling workstation whenever the machine is being set up, operated, or maintained. It ensures safe and consistent procedures are followed during all milling operations.
Definitions:	CNC (Computer Numerical Control): A computer-based system that automates the control of machine tools through programmed commands, eliminating the need for manual operation of levers or handwheels. Milling Machine: A machine tool that rotates a cutting tool against a stationary or moving workpiece to remove material and produce a desired shape or surface finish. Workpiece: The raw material (metal, plastic, composite, etc.) that is machined to form a finished component. CAM Software (Computer-Aided Manufacturing): Specialized software used to convert a CAD model into machine-readable instructions (tool paths, feeds, speeds, and cutting sequences). CAM software generates the G-code and M-code necessary to operate CNC milling machines accurately and efficiently.

Responsibilities:	Operator: Sets up material and tools, runs the CNC program, monitors machining, and does basic part checks. Programmer: Prepares CAM programs, selects tooling, and optimizes feeds/speeds. Supervisor: Ensures safety rules are followed, assigns tasks, and approves setups or first parts. Inspector: Measures and records part dimensions to confirm they meet tolerances. Maintenance: Handles machine upkeep, coolant/lube checks, and fixes issues when needed.
Materials and Equipment:	■ Raw material (metal, plastic, wood) ■ Cutting tools (end mills, drills, taps) ■ Tool holders & collets ■ Workholding (vise, clamps, fixtures) ■ Coolant/lubricant ■ Measuring tools (calipers, micrometer, indicator) ■ Safety gear (glasses, hearing protection) ■ Computer with CAM software

Procedure Steps:	■ Pre-Procedure: ○ Ensure your own familiarity with CNC softwares such as “nesting” and “tool pathing” ○ Familiarize yourself with the ON/OFF emergency controls ○ Ensure the position of the front guard door and safety devices are secure ○ Discard any material NOT suitable for this turning process ○ Ensure that the mill cutter bit dimensions are according to specifications. Isolate the machine if adjustments are to be made to the milling head or tool cradle. ○ Ensure cutters are sharpened and clean from debris of previous use ○ Adjust the waste collector fitting for maximum efficiency ○ Maintain the area clear and be aware of personnel in the immediate vicinity ■ PROCEDURE: ○ NEVER program this CNC machine for operations beyond its specification capacity. ○ Confirm ALL CNC programming instructions before starting ○ Ensure the work piece is correct and secured ○ Confirm positive levels and temperatures of system coolant ○ Ensure any interchangeable tool heads are unobstructed for any operation ○ NEVER leave the CNC mill under operation without supervision or close monitoring ■ Post-Procedure: ○ Isolate any/all switches ○ Leave the work area clean and tidy of debris or waste in a safe manner.
Safety and Compliance:	■ Only trained personnel may operate CNC machinery. ■ Always use emergency stop systems if unsafe conditions arise. ■ Maintain proper use of guards and isolation during adjustments. ■ Do not override machine capacities or safety features.

Troubleshooting / Exceptions:	■ MACHINE WILL NOT TURN ON: If the machine will not turn on, first disconnect it from the power and assure that none of the power cables are damaged. Next reconnect the power cable and follow the standard procedure for powering the machine. If the issue persists, call maintenance for further assistance. ■ MACHINE IS STUCK: If the machine appears to be stuck, immediately disconnect power. Be sure there are no objects in the way of the joints or gears of the machine. Next reconnect the power cable and follow the standard procedure for powering the machine. If the issue persists, disconnect the machine once more and call maintenance for further assistance. ■ MACHINE WILL NOT CUT THROUGH MATERIAL: If the machine is unable to through, then stop the machine's current tasks and assure the material is within the rating for the machine's capabilities. If this is the case, increase the power and try again. If the issue persists, disconnect the machine and call maintenance for further assistance

Revision History

Revision	Date	Description of Change	Approved by
0.1	09-02-2025	Initial draft	Fairuz S.
0.2	09-03-2025	Added Safety & Troubleshooting	Fairuz S.
0.3	09-03-2025	Added Procedure steps & updated Responsibilities	Fairuz S.
1.0	09-04-2025	Finalized SOP	Fairuz S.