



**ONTARIO COLLEGE OF TRADES**  

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**ORDRE DES MÉTIERS DE L'ONTARIO**

Apprenticeship  
Training Standard

Schedule of Training

Computer Numerical Control  
(CNC) Programmer

Trade Code: 670C

Development Date: 2005

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## **PREFACE**

This Schedule of Training was developed by the Strategic Policy and Programs Division, Programs Branch of the Ministry of Training, Colleges, and Universities (MTCU), in partnership with the Industry Advisory Committee and in consultation with representatives from the industry. This document is intended to be used by apprentice, supervisor/trainer and sponsor/employer as a "blueprint" for training and as a prerequisite for completion and certification.

This training document becomes the apprentice's only record of workplace training performance.

Supervisor/trainer and apprentice are required to sign off and date the skill following each successful acquisition, unless a skill is marked shaded (optional).

**The care and maintenance of this training document are the joint responsibility of the apprentice and the sponsor/employer. By signing off the skill, the supervisor/trainer and the apprentice are indicating that the apprentice has demonstrated competence of the skill. This training standard has been developed specifically for documenting the apprentices' acquisition of skills of the trade.**

## **DESCRIPTION/CRITERIA FOR THIS APPRENTICESHIP**

**This apprenticeship is to be granted only to an individual who has successfully completed a Certificate of Qualification for General Machinist – 429A, Mould Maker – 431A, Tool and Die Maker – 430A, Tool/Tooling Maker – 630T, and Pattern Maker – 443A.** Those journeymen who has successfully completed a Certificate of Apprenticeship, with the Training Standards signed off prior to receiving a Certificate of Qualification will have an advantage in successfully completing this post-certification training. The candidate must have on-the-job experience as a Journeyman.

The completion of this training plan will give the journeyman the generic/basic programming skills which will enable them to create (with additional on-the-job training) programs for CNC and DNC controlled machines.

Programming includes: creating tool paths, producing CNC code language, translating from electronic design into tool path, translating from CAD and engineering drawings, translating from piece part, performing digitization (CMM), generating cutter paths, creating surface models, creating solid models, creating wire-frame models, creating cutting and machining processes, and creating tooling and workholding processes.

## **DEFINITIONS**

### **ACA**

Apprenticeship and Certification Act, 1998

### **Certificate of Apprenticeship (C of A)**

Certification issued to individuals who have demonstrated that they have completed an apprenticeship in Ontario.

### **Certificate of Qualification (C of Q)**

Certification issued to C of Q applicants who have achieved a passing grade on the certification exam for their trade.

### **Competence**

The ability of an individual to perform a skill repeatedly and without assistance in the workplace to the standard set out in the Training Standard or Schedule of Training.

### **Competency Analysis Profile**

A document that identifies the training needs of an individual trade and details the skills/skill sets that must be demonstrated.

### **Industry Committee (IC) - under the ACA and Provincial Advisory Committee (PAC) under the TQAA**

Under the ACA and TQAA, the Minister may appoint a provincial committee in any trade or group of trades to advise the Minister in matters relating to the establishment and operation of apprenticeship training programs and trades qualifications.

### **Journeyman or Equivalent**

A person who has acquired the knowledge and skills in a trade, occupation or craft as attested to by a provincial or territorial authority.

### **Mandatory**

Status assigned to unshaded individual skills, skill sets or general performance objective which must be signed off for the apprentice to complete their program.

### **Optional**

Status assigned to shaded individual skills, skills sets or general performance objective for which sign-off is not required for the apprentice to complete the program.

### **Schedule of Training**

An apprenticeship training standard which includes the on-the-job performance objectives and off-the-job learning outcomes

**Sign-off**

Signature of the sponsor/employer of record or an individual, to whom that sponsor or employer has delegated signing authority, indicating an apprentice's achievement of competence.

**Skill**

Individual skill described in the Training Standard (note: does not mean the larger skill groups referred to in the Training Standard as Skill Sets, Training Units, or General Performance Objective, but the individual skills that make up those groups).

**Skill Sets**

Group of individual skills found in the Training Standard (may also be called Training Unit or General Performance Objective)

**Skill Set Completion Form (and Learning Outcome Completion Form)**

Lists all skill sets and includes space for sign-off by sponsor/employer of record.

**Sponsor/Employer**

Means a person that has entered into a registered training agreement under which the person is required to ensure that an individual is provided with workplace-based training in a trade, other occupation or skill set as part of an apprenticeship program approved by the Director.

**Sponsor/Employer of Record**

Refers to the sponsor or employer documented as the signatory to the current training agreement or contract. In order for an sponsor/employer to be considered for the training of apprentices, they must identify that the workplace has qualified journeypersons or equivalent on site and can identify that the workplace has the tools, equipment, materials, and processes which have been identified by Provincial Advisory Committees (PACs) or Industry Committees (ICs) to be required for the trade.

**Supervisor**

An individual, who oversees the execution of a task, oversees the actions or work of others.

**Trainer**

A qualified trainer in a compulsory trade is a journeyperson with a Certificate of Qualification or in a voluntary trade is an individual who is considered equivalent to a journeyperson with a Certificate of Qualification.

**TQAA**

Trades Qualification and Apprenticeship Act.

**Training Standard**

A document that has been written in concise statements, which describe how well an apprentice must perform each skill in order to become competent. In using the document, trainers will be able to ensure that the apprentice is developing skills detailed for the occupation.

## **IMPORTANT DIRECTIONS**

### **Apprentice**

1. All complete skills or skill sets must be signed and dated by both the apprentice and sponsor/employer when either all terms of the contract have been completed or the apprentice leaves the employ of the employer.
2. It is the responsibility of the apprentice to inform the local Apprenticeship Client Services Office regarding the following changes:
  - change of sponsor/employer address;
  - change of apprentice name or address;
  - transfer to a new sponsor/employer.
3. The Skill Set Completion Form and Learning Outcome Completion Form must be completed and signed by the current sponsor/employer and presented to the local Apprenticeship Client Services Office at the fulfillment of all terms of a Training Agreement.
4. The apprentice completion form with the Completed and Authorized Schedule of Training must be presented to the local Apprenticeship Client Services Unit.

### **Sponsors/Employers and Supervisors/Trainers**

The Schedule of Training identifies skills and supporting learning outcomes required for this trade/occupation and its related training program.

This Schedule of Training has been written in concise statements which describe how an apprentice must perform each skill/outcome in order to become competent. Competence means being able to perform the task to the required standard.

In using this training standard, supervisors/trainers will be able to ensure that the apprentice is developing the skills detailed for the trade/occupation.

Supervisors/Trainers and apprentices are required to sign off and date the skills following each successful acquisition.

Sponsors/Employers participating in this training program will be designated as the Signing Authority and are required to attest to successful achievement by signing the appropriate box included at the end of each skill set.

## NOTICE OF COLLECTION OF PERSONAL INFORMATION

1. At any time during your apprenticeship training, you may be required to show this training standard to the Ministry of Training, Colleges and Universities (the Ministry). You will be required to disclose the signed Apprenticeship Completion form to the Ministry in order to complete your program. The Ministry will use your personal information to administer and finance Ontario's apprenticeship training system, including confirming your completion and issuing your certificate of apprenticeship.
2. The Ministry will disclose information about your program completion and your certificate of apprenticeship to the Ontario College of Trades, as it is necessary for the College to carry out its responsibilities.
3. Your personal information is collected, used and disclosed by the Ministry under the authority of the Ontario College of Trades and Apprenticeship Act, 2009.
4. Questions about the collection, use and disclosure of your personal information by the Ministry may be addressed to the:

Manager, Employment Ontario Contact Centre  
Ministry of Training, Colleges and Universities  
33 Bloor St. E, 2nd floor, Toronto, Ontario M7A 2S3  
Toll-free: 1-800-387-5656; Toronto: 416-326-5656  
TTY: 1-866-533-6339 or 416-325-4084.

Please Note: Apprenticeship Training and Curriculum Standards were developed by the Ministry of Training, Colleges and Universities (MTCU). As of April 8th, 2013, the Ontario College of Trades (College) has become responsible for the development and maintenance of these standards. The College is carrying over existing standards without any changes.

However, because the Apprenticeship Training and Curriculum Standards documents were developed under either the Trades Qualification and Apprenticeship Act (TQAA) or the Apprenticeship and Certification Act, 1998 (ACA), the definitions contained in these documents may no longer be accurate and may not be reflective of the Ontario College of Trades and Apprenticeship Act, 2009 (OCTAA) as the new trades legislation in the province. The College will update these definitions in the future.

Meanwhile, please refer to the College's website (<http://www.collegeoftrades.ca>) for the most accurate and up-to-date information about the College. For information on OCTAA and its regulations, please visit: <http://www.collegeoftrades.ca/about/legislation-and-regulations>

## **ROLES & RESPONSIBILITIES OF APPRENTICE, SPONSOR/EMPLOYER AND SUPERVISOR/TRAINER**

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### **Apprentice “Apprenticeship is Learning On-the-job”**

- Practice safe work habits.
- Use your apprenticeship training standard as a journal to keep track of which skills you have achieved.
- Talk over your training plan with your Training Consultant, Employer, Union, or Sponsor.
- Know what tools are required for your trade and how to use them.
- Ask questions and keep asking.
- Talk to your employer about your training needs.
- Demonstrate enthusiasm and good work habits.
- Ensure that you and your supervisor/trainer sign off skill/skill sets upon demonstration of competency.

### **Sponsor/Employer “Training is an Investment”**

- Demonstrate safe work habits.
- Attest to successful achievement by signing the skill/skills sets.
- Provide opportunities and time for the apprentice to learn the trade.
- Offer practical trade training experiences that cover all of the skill sets.
- Foster work ethics that support training while minimizing productivity losses.
- Set out clear expectations, then recognize or reward performance excellence.
- Involve both the apprentice and supervisor/trainer in developing the training plan.
- Use the Training Standard as a monitoring tool and part of regular performance evaluations.
- Select supervisors/trainers with good communication skills and who work well with others.
- Encourage supervisors/trainers to take upgrading courses - (e.g. Train the Trainer, Mentor Coach, etc).
- Complete the Skill Set Completion Form once the apprentice has demonstrated competency in the training.
- Ensure that the apprentice always works under the direction of or has access to a qualified supervisor/trainer.
- Vary the apprentice’s exposure to all the skills set out in the training standard.

**Supervisor/Trainer**

- Demonstrate safe work habits.
- Treat apprentices fairly and with respect.
- Use the Training Standard as a guide to evaluating competence in each skill area. In using the Training Standard, supervisors/trainers will be able to ensure that the apprentice is developing skills detailed for the trade/occupation.
- Review the Training Standard with the apprentice and develop a training plan.
- Respond fully to all questions.
- Be patient. Explain what is to be done then, show how it is done, and then let the apprentice demonstrate the task.
- Provide continuous feedback.
- Sign off individual skills/skill sets once the apprentice demonstrates competence in the skill.

**Suggestions for Assessing the Progress of the Apprentice in the Workplace**

- Use informal daily observation.
- Provide constructive feedback to build confidence.
- Allow the supervisor/trainer time to teach and demonstrate the skills.
- Take prompt action wherever problems occur.
- Conduct regular performance reviews involving the apprentice, supervisor/trainer and sponsor/employer.
- Use the Training Standard as the reference for establishing the competency of the apprentice.

**SKILL SET COMPLETION FORM**

| <b>SKILLS SETS</b> | <b>TITLE</b>   | <b>SIGNING AUTHORITY</b> |
|--------------------|--|--------------------------|
| <b>U0711.0</b>     | <b>DEMONSTRATE SAFE WORKING PRACTICES AND TECHNIQUES</b> |                          |
| <b>U0712.0</b>     | <b>DEFINE AREAS OF WORKPIECE TO BE MACHINED</b>          |                          |
| <b>U0713.0</b>     | <b>DETERMINE CNC PROGRAMMING OPERATIONS</b>              |                          |
| <b>U0714.0</b>     | <b>PLAN THE METAL REMOVAL PROCESS</b>                    |                          |
| <b>U0715.0</b>     | <b>DEVELOP TOOL PATHS</b>                                |                          |
| <b>U0716.0</b>     | <b>POST-PROCESS TOOL PATH INFORMATION</b>                |                          |
| <b>U0717.0</b>     | <b>GENERATE CNC JOB DOCUMENTATION</b>                    |                          |
| <b>U0718.0</b>     | <b>IMPLEMENT CNC MACHINING PROCESS</b>                   |                          |
| <b>U0719.0</b>     | <b>OPTIMIZE PROGRAM</b>                                  |                          |
| <b>U0720.0</b>     | <b>ARCHIVE/MAINTAIN FILES</b>                            |                          |

**NOTE ON SHADED PERFORMANCE OBJECTIVES AND SKILLS:**

- Shaded performance objectives and skill sets are optional. The shaded skills do not have to be demonstrated or signed-off for completion of the on-the-job component of the apprenticeship
- The learning outcomes will cover all of the skill sets, both shaded and unshaded.

**APPRENTICE COMPLETION FORM**

| <b>APPRENTICE NAME</b>  |  |
|-------------------------|--|
| Print                   |  |
| Signature               |  |
| Social Insurance Number |  |

Skill Sets and Learning Outcomes when completed should be signed by the Supervisor/Trainer and presented with this completion form to your local Apprenticeship Client Services Office. Any supporting documentation should also be attached.

In-school Completed                      Yes ( )              No ( )              Not applicable ( )  
 (Proof to be provided)

Hours completed as  
 Per Contract:                      Yes ( )              No ( )              Not applicable ( )

| <b>SPONSOR/EMPLOYER INFORMATION</b> |  |
|-------------------------------------|--|
| Name                                |  |
| Address                             |  |
| Telephone                           |  |
| E-mail Address                      |  |
| Signature of Signing Authority      |  |

**A. DESCRIPTION/DUTIES**

A **CNC Programmer** develops programming for Computerized Numerical and Direct Numerical controlled machines by:

- Demonstrating Safe Work Practices and Techniques
- Defining Areas of Workpiece to be Machined
- Determining CNC Programming Operations
- Planning the Metal Removal Process
- Developing Tool Paths
- Post-Processing Tool Path Information
- Generating CNC Job Documentation
- Implementing CNC Machining Processes
- Optimizing Programs
- Archiving/Maintaining Files

A **CNC Programmer** demonstrates knowledge of:

- Occupational Health and Safety Act
- Drafting Techniques
- Metal Machining Technology and Techniques
- Numerical Control Technology
- Computer Aided Design
- Computer Aided Manufacturing

**BENCHMARK/GUIDELINE TOTAL TRAINING TIMEFRAMES:  
(ON-THE-JOB AND OFF-THE-JOB):**

Approximately 24 Months/4,000 hours  
Includes **240** hours of in-school training.

**B. ON-THE-JOB PERFORMANCE OBJECTIVES****U0711.0 DEMONSTRATE SAFE WORKING PRACTICES AND TECHNIQUES**

**Demonstrate safe working practices and techniques** by recognizing and handling potential health and safety hazards and hazardous materials; wearing personal protective equipment and clothing; maintaining good housekeeping; and following fire procedures; in compliance with Safety Regulations, Environmental Protocols, Codes, and Regulations.

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**U0712.0 DETERMINE AREAS OF WORKPIECE TO BE MACHINED**

**Determine areas of workpiece to be machined** by extracting information from engineering drawings, CAD data, or digitized files to identify part geometry, type of workpiece, machining and tooling requirements.

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**U0713.0 DETERMINE CNC PROGRAMMING OPERATIONS**

**Determine CNC programming operations** by identifying geometric features of the workpiece, so that cutter paths can be developed in order to produce the required parts, in accordance with engineering drawings, CAD data, and job requirements.

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**U0714.0 PLAN THE METAL REMOVAL PROCESS**

**Plan the metal removal process** by identifying the sequence of machining operations, set-up procedures, machine type, tooling, workholding devices, and accessories, so that the scope of the programming task is determined and the plan is completed for the production of the part, in accordance with engineering drawings, CAD data, and job requirements.

---

 Date Completed

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 Apprentice

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 Supervisor/Trainer
**U0715.0 DEVELOP TOOL PATHS**

**Develop tool paths** by creating part geometry, orienting part location, modifying the geometry, and adding to existing geometry, so that the part is cut in accordance with machining practices, engineering drawings, CAD data, and job requirements.

---

 Date Completed

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 Apprentice

---

 Supervisor/Trainer
**U0716.0 POST-PROCESS TOOL PATH INFORMATION**

**Post-process tool path information** into CNC codes for individual machine controls by viewing a tool path simulation, checking the finished part, and optimizing the program, so that all downloaded information is verified and conforms to the engineering drawings and CAD data.

---

 Date Completed

---

 Apprentice

---

 Supervisor/Trainer
**U0717.0 GENERATE CNC JOB DOCUMENTATION**

**Generate CNC job documentation** by creating a set-up folder which includes location of coded information, run time, scheduling sheet, engineering drawings, CNC program(s), tooling/offset lists, and set-up sheets, so that completed programs are organized and retrievable.

---

 Date Completed

---

 Apprentice

---

 Supervisor/Trainer

**B. ON-THE-JOB PERFORMANCE OBJECTIVES****U0718.0 IMPLEMENT CNC MACHINING PROCESS**

**Implement CNC machining process**, by loading program into the CNC machine control and verifying that the information for part location, cutting tools, and offset data is initiated and runs as specified.

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**U0719.0 OPTIMIZE PROGRAM**

**Optimize program** by making adjustments or changes so that the part is machined in accordance with engineering drawings, CAD data, company standards, and job requirements.

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**U0720.0 ARCHIVE/MAINTAIN FILES**

**Archive/maintain files** so that all programming files and information are stored, identified, and retrievable for future use.

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**C. LEARNING OUTCOMES**

**S0681 Computer Numerical Control Technology - 12 hours**

Upon successful completion the apprentice will be able to describe the principles and applications of Computer Numerical Control (CNC) Technology and CNC Machining methodologies.

**S0682 Develop Geometric Forms using Computer Aided/Assisted Design (CAD) and Computer Aided Manufacturing (CAM) - 72 hours**

Upon successful completion, the apprentice will be able to develop geometric forms using Computer Aided/Assisted Design (CAD) and Computer Aided Manufacturing (CAM) techniques.

**S0683 Manual Computer Numerical Control (CNC) Programming Techniques - 84 hours**

Upon successful completion, the apprentice will be able to demonstrate manual Computer Numerical Control (CNC) programming.

**S0684 Computer Aided Manufacturing (CAM) Applications - 72 hours**

Upon successful completion, the apprentice will be able to demonstrate Computer Aided Manufacturing applications and technology.

**The apprentice will be able to use a model/template to generate a CNC program which includes drilling, tapping, contouring with angles and radii, pockets with 2 or more islands, and at least one feature requiring simultaneous movement of 3 axes by the machine tool over a sculptured surface.**

**APPRENTICE RECORD**

|                                 |
|---------------------------------|
| <b>APPRENTICE NAME (Print):</b> |
|---------------------------------|

| <b>SPONSOR/EMPLOYER INFORMATION</b> |  |
|-------------------------------------|--|
| Training Agreement #                |  |
| Name                                |  |
| Address                             |  |
| Telephone                           |  |
| E-mail Address                      |  |

| <b>SUMMARY OF TRAINING</b>   |  |
|--|--|
| Employment Start Date  |  |
| Employment End Date  |  |
| Total hours of training & instruction between dates of employment. |  |

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**APPRENTICE RECORD**

|                                 |
|---------------------------------|
| <b>APPRENTICE NAME (Print):</b> |
|---------------------------------|

| <b>SPONSOR/EMPLOYER INFORMATION</b> |  |
|-------------------------------------|--|
| Training Agreement #                |  |
| Name                                |  |
| Address                             |  |
| Telephone                           |  |
| E-mail Address                      |  |

| <b>SUMMARY OF TRAINING</b>   |  |
|--|--|
| Employment Start Date  |  |
| Employment End Date  |  |
| Total hours of training & instruction between dates of employment. |  |

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**APPRENTICE RECORD**

|                                 |
|---------------------------------|
| <b>APPRENTICE NAME (Print):</b> |
|---------------------------------|

| <b>SPONSOR/EMPLOYER INFORMATION</b> |  |
|-------------------------------------|--|
| Training Agreement #                |  |
| Name                                |  |
| Address                             |  |
| Telephone                           |  |
| E-mail Address                      |  |

| <b>SUMMARY OF TRAINING</b>   |  |
|--|--|
| Employment Start Date  |  |
| Employment End Date  |  |
| Total hours of training & instruction between dates of employment. |  |

\_\_\_\_\_  
Date Completed

\_\_\_\_\_  
Apprentice

\_\_\_\_\_  
Supervisor/Trainer

**You will be required to disclose this signed form to the Ministry of Training, Colleges and Universities in order to complete your program. The Ministry will use your personal information to administer and finance Ontario’s apprenticeship training system. For further information please see the notice/declaration for collection of personal information that is referenced in the table of contents of this training standard.**