

PROGRAM INFORMATION

Academic Year	2024 – 2025
Credential	Ontario College Diploma
Program Delivery	Full - Time
Duration	2 Years
Length	4 Semesters Co-op 6 Semesters
Program Codes	W010 (4 Semesters) W138 (Co-op, 6 Semesters)

DESCRIPTION

More than arcs and sparks.

Northern's Welding Engineering Technician: Inspection program is a deep dive into the science, technology and engineering of welding and places you at the top of your game. You'll master everything from metallurgy to magnetic particle inspection; you'll understand modes of metal transfer during welding, the mathematics of force calculations, and the minimum requirements of welding codes. And – as a result – you'll be able to play a key role in the design, manufacture and maintenance of safe structures that stand the test of time. Combining theory and practical lab exercises, you'll be transformed into a welding professional, capable of working in a multitude of diverse, high-paying roles found within a wide array of industries.

Offered in both co-op and regular formats, the program prepares you for a job as an inspector, supervisor, educator, consultant, and more. You can also sign up for an extra year of study to complete an advanced diploma in [Welding Engineering Technology](#).

Welding professionals are concerned with all activities related to the design, production, performance, and maintenance of welded products. To adequately design a weldment, the welding professional must not only understand the material being joined, but also the effect of welding variables of many welding processes on the final product. To achieve this, lab time is intertwined with a curriculum of metallurgical science and engineering theory. In developing the skills required in becoming a welding inspector, students complement their knowledge of non-destructive examination with a working knowledge of codes, standards and stress analysis.

The Welding Engineering Technician Program is not just about arcs and sparks; it is about science, technology, and the engineering of welding. Our students learn to develop, qualify, and implement welding procedures; to use their knowledge of welding, metallurgy, mechanics, and electrical engineering in the design and manufacturing of safe structures; and to inspect and maintain the integrity of such structures while they are in service.

[Welding Program Pathways \(PDF\)](#)

Graduates of the Welding Technician Program may choose to continue their studies and complete an additional year in order to obtain a diploma in Welding Engineering Technology.

CAREER OPPORTUNITIES

Technicians can select components, create and/or interpret drawings and supervise welding personnel. Graduates may find employment in the following fields/positions: Quality Control/Assurance, Inspection, Education, Consulting, First-level management, and/or Technical Sales.

- Welding visual inspection technician
- Weld tester
- Employed by quality control, maintenance and safety departments of manufacturing, processing, transportation, energy, and other companies and by private industrial inspection establishments

VOCATIONAL LEARNING OUTCOMES

1. Perform safe work practices in the welding shop in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Industrial Establishments.
2. Interpret drawings that would typically be used in a manufacturing and/or fabricating environment.
3. Perform trade related mathematical calculations including volume, area, estimation, geometry, ratio, measurement, weights, loads, and centering of various lifts.
4. Use the main cutting, gouging, and welding processes of the fabrication industry to complete practical projects.
5. Perform hands on all position shielded metal arc welding, gas metal arc welding, flux core arc welding, gas tungsten arc welding utilizing mild steel and structural shapes with various consumables.
6. Perform open root welding on plate and pipe in all positions using the shielded metal arc welding (SMAW) process.
7. Describe and identify the common weld defects and faults using destructive and non destructive examination and testing methods.
8. Identify and troubleshoot mechanical problems; recommend solutions for repairing and maintaining equipment to industry standard.
9. Identify the applicable code(s) or standards to be used in conjunction with each specific fabrication activity.
10. Describe and perform distortion control and correction techniques as they apply to expansion and contraction forces.
11. Identify appropriate lifting devices and equipment according to weight calculations.

PROGRAM COURSES

The following reflects the planned course sequence for full-time offerings of the program. Programs at Northern College are delivered using a variety of instruction modes. Courses may be offered in the classroom or lab, entirely online, or in a hybrid mode which combines classroom sessions with virtual learning activities.

Semester 1	Hours
CM1323 Professional Communications	42
General Education Elective	42
GN1033 Health and Safety	42
IN1173 Computer Applications for Business	42
MA1100 Mathematics I	56
WE1023 Codes and Standards	30
WE1064 Welding Drafting	60
WE1082 Welding Electrical Fundamentals	30
WE1404 Materials Joining	60
 Semester 2	
CM2303 Communications for the Workplace	42
GN1443 Indigenous Culture and Awareness	42
GN2013 Co-op Studies	30
MA2104 Mathematics II	56
WE2024 Engineering Materials I	60
WE2084 Mechanic/Statics	60
WE2164 CAD & Fixture Design	60
WE3014 Materials Preparation	60
 Semester 3	
General Education Elective	42
MA3033 Mathematics III	45
WE3044 Strength of Materials I	60
WE3104 Engineering Materials II	60
WE3112 Materials and Processes	32
WE3113 Magnetic Particle Testing	40
WE3123 Liquid Penetrant Testing	40
WE3204 Welding Processes I	60
 Semester 4	
BU1363 Introduction to Business Concepts	42
WE4004 Welding Processes II	60
WE4024 Welding Metallurgy I	60
WE4073 Radiographic Inspection	48
WE4083 Ultrasonic Inspection	60
 Co-Op Work Terms	
WE3010 Work Term I (Co-op)	520
WE5010 Work Term II (Co-op)	520

PROGRAM PROGRESSION

The following reflects the planned progression for full-time offerings of the program. Students in the non co-op program do not complete co-op work term semesters (in **bold**).

Fall Intake

Sem 1: Fall 2024

Sem 2: Winter 2025

Co-op Work Term: Summer 2025

Sem 3: Fall 2025

Sem 4: Winter 2026

Co-op Work Term: Summer 2026

WORK INTEGRATED LEARNING OPPORTUNITIES

The co-operative education option allows students to 'earn while they learn' and is a fantastic way to gain real-life experience. The curriculum includes a heavy emphasis on labs, which simulate the on-the-job problems that a welding engineering technician would encounter.

ARTICULATION/TRANSFER AGREEMENTS

A number of articulation agreements have been negotiated with universities and other institutions across Canada, North America and internationally. These agreements are assessed, revised and updated on a regular basis. Please contact the program coordinator for specific details if you are interested in pursuing such an option. Additional information can be found at [Articulation Agreements](#).

ADDITIONAL INFORMATION

N/A

PROGRAM SPECIFIC REQUIREMENTS

Program specific requirements can be found in the Required Equipment and Supplies document.

ADMISSION REQUIREMENTS

- Ontario Secondary School Diploma (OSSD)
- Grade 12 English (C, U)
- Grade 12 Math (C, U) (MCT4C preferred; MAP4C is accepted with a minimum GPA of 60%)
- Grade 12 Physics (C, U) strongly recommended
- Or equivalent

Academic prerequisites for this program may be obtained free of charge through [Academic Upgrading](#). Applicants who do not have a high school diploma or equivalent and will have reached the age of 19 years on or before the start of the program must undergo academic testing and may be required to complete [Prior](#)

[Learning Assessment & Recognition \(PLAR\)](#) process to demonstrate equivalency of admission requirements prior to admission into a program. For more details, please contact the Admissions Office at 705-235-7222 or admissions@northern.on.ca.

Additional Requirements for International Students

In addition to the general admission requirements, international students must have proof of English Proficiency and meet the requirements below.

1. Proof of Senior High School Diploma/Certificate
2. English Proficiency (we will require one of the following):
 - IELTS Academic International English Language Testing System: minimum overall score of 6.0 must be achieved with no individual band score under 6.0; however, we will accept one band at 5.5.
 - TOEFL (Test of English as a Foreign Language): Computer-based overall minimum score of 79
 - PTE (Pearson Test of English) Academic – Graduate Diploma: 58+

If your country of citizenship has English as its official language, we may accept alternate proof of English Proficiency. All educational documents must be submitted in English and will be dependent on the country of citizenship. For more information, please contact admissions@northern.on.ca.

GRADUATION REQUIREMENTS

- 26 Program Courses
- 2 Communications Courses
- 4 General Education Courses

GRADUATION ELIGIBILITY

To graduate from this program, a student must attain a minimum of 60% or a letter grade of CR (Credit) in each course in each semester unless otherwise stated on the course outline. Students should consult departmental policies and manuals for additional detail and exceptions.

GRADUATION WINDOW

Students unable to adhere to the program duration of two years (as stated above) may take a maximum of four years to complete their credential. After this time, students must be re-admitted into the program, and follow the curriculum in place at the time of re-admission.

CONTACT INFORMATION

For questions about being admitted into the program, please contact Northern College Admissions at admissions@northern.on.ca or by phone at 705-235-3211 ext. 7222. For questions about the content of the program, contact the Program Coordinator.

Joshua Fuller, Program Coordinator
Tel: 705-567-9291 ext. 3750
Email: welding@northern.on.ca

COURSE DESCRIPTIONS

Semester 1

CM1323 Professional Communications

In this course, students will learn essential skills for success in college and the workplace. This course focuses on developing and strengthening oral and written communication skills, and critical thinking ability. During this course, students will engage in a variety of forms of communication with a focus on upholding the principles of academic integrity. Students will develop the skills necessary to create discipline-specific documents, practice business etiquette and professionalism, and apply critical thinking strategies to practical scenarios. Upon successful completion of this course, students will be able to plan and draft concise, coherent and well-organized writing assignments that are tailored to specific audiences and purposes.

General Education Elective

General Education Courses are selected online each semester by the student from a list provided and exposes students to a related area of study outside of their immediate academic discipline. Certain programs have predetermined electives.

GN1033 Health and Safety

This course introduces the student to health and safety in their home, in society and within an occupational setting. Students learn about the social and personal benefits of safe work practices and the methods to best prevent accidents or injuries. Students will review the role, rights and responsibilities of an individual in today's health and safety conscious world. Students also learn how to read and interpret the Occupational Act and Regulations.

IN1173 Computer Applications for Business

In this course, students will gain practical experience with the essential features of Microsoft Office – MS Word, MS Excel, and MS PowerPoint to enhance their communication and analytical skills. Basic computer skills are required as prerequisite. Students will gain hands-on experience with file management, software settings, system security, Word Reports (APA Functions), tables, advanced presentation functions, summarizing and analyzing data in Excel through a series of learning activities, projects, and exercises that focus on real world examples. Students gain practical knowledge that can be applied directly to the workplace setting.

MA1100 Mathematics I

This course covers basic algebra properties, graphing the straight line, basic geometry and trigonometry, and solving a system of equations graphically and algebraically. It also covers vector addition by components and by the cosine and sine laws.

WE1023 Codes and Standards

The principle objective of this course is to provide students with an understanding of code philosophy and rationale along with a working knowledge and application of welding related codes and standards. Codes and standards discussed include ISO9000, CSA W47.1, CSA W59, ASME Section IX and ASME Section VIII.

WE1064 Welding Drafting

This introductory course is assignment-based with the objective of solving elementary drafting problems for machine shop and welded fabrication consistent with industrial practice. Topics include: basic drafting skills,

theory of shape description, auxiliary views, dimensioning, sections, detail and assembly drawings, pictorial drawings, structural drafting, geometric dimensioning and tolerancing, and welding symbols.

WE1082 Welding Electrical Fundamentals

This is an introductory course in electrical fundamentals covering the basic electrical components used in welding equipment, and use of a multimeter. It also includes the analysis of series and parallel circuits. Students will be introduced to solid state electronics and will also study half and full wave rectifier circuits.

WE1404 Materials Joining

This course begins with an overview of all joining methods including: mechanical, adhesive and welding. The major emphasis of the course is on the SMAW process. Students will practice welding techniques and will acquire data in order to submit neat comprehensive technical lab reports including welding procedure specification sheets. In addition, students will develop an understanding of the basic factors controlling the cost of welding and will be required to use lab and reference data to calculate welding costs. Students are introduced to welding defects as designated by the International Institute for Welding along with causes and possible remedies. Students will also be introduced to various welding codes and their areas of application.

Semester 2

CM2303 Communications for the Workplace

In this course, students will develop professional communication skills required for success in the workplace. Students will continue to develop and strengthen their oral and written communication skills and critical thinking abilities. During this course, students will use various modes of communication to complete assignments designed to meet program and professional expectations. Students will utilize a variety of technologies for the purpose of creating a professional presence in a digital environment. Students will develop the necessary skills to create polished workplace documents such as letters, resumes, cover letters and reports tailored to specific audiences. Students will learn to conduct themselves with professionalism in both workplace interviews and job searches. Upon successful completion of this course, students will be able to create clear, concise and coherent workplace and employment documents that are error-free and designed for specific audiences and purposes.

GN1443 Indigenous Culture and Awareness

This general education course will provide students with an introduction to Canadian Indigenous Nations' history, sovereignty, land titles, cultural history and current critical issues. Topics addressed include the content of Indigenous rights, economic and social development, community and political processes, and business law and policies, justice & social services. Canadian Indigenous History and Relations is a general education course that has been incorporated into all programs at Northern College.

GN2013 Co-op Studies

This course is intended to raise awareness of the importance of experiential learning through the co-operative education process. The student is encouraged to actively identify and discuss the merits of a three-way partnership between the college, the employer, and the student. Various skills are introduced to help the student prepare himself/herself using self-assessment, career planning, and job search tools.

MA2104 Mathematics II

MA2104 is the second course in the math stream for students in an Engineering Technician / Technology program. The emphasis of this course is on solving equations relating to quadratics, logarithms, exponentials, with sections on factoring, fractional equations, manipulating exponent and radical expressions, and complex numbers, and for some programs studying systems of linear equations and determinants. Applications of the basic concepts, to particular fields of study, will be covered. The second semester Mathematics course is designed to give the student the mathematical tools required to function in his/her special field of study. Students are encouraged to seek help after class hours if problems are encountered in the course. Every effort will be made to identify problem areas to the student, but in the final analysis, it is the responsibility of the student to ask for help. Prerequisite: MA1100 – Mathematics I (with 60%)

WE2024 Engineering Materials I

This is an introduction to the chemical and physical principles underlying the nature and behaviour of engineering materials. After an elementary examination of the common units of which all materials consist, the course discusses how different arrangements of these units bring forth specific types of materials with unique properties (metals, polymers, ceramics and composites). The main aim of the course is to stimulate the student's interest in this field and establish an understanding of the basic principles that will be explored more extensively in numerous subsequent courses. Topics include: the structure of materials, imperfections in solids, diffusion, properties and selection, dislocations and strengthening mechanisms, failure of materials, solidification, and phase diagrams.

WE2084 Mechanic/Statics

Mechanics is the study of forces acting on objects (statics and dynamics). This course focuses on statics, the study of objects in equilibrium. Applied mechanics deals with the basic concepts of forces and is the origin for all calculations in areas such as stress analysis, structural design and weldment design. This course begins with a review of basic trigonometry, laws of triangles and unit conversion. Major topics include introduction to forces and moments, forces acting on truss and frame members, friction, centroids, moments of inertia, and radius of gyration. Both SI and Imperial System units are used.

WE2164 CAD & Fixture Design

This course consists of two parts. The first part of the course is an introduction to computer-aided design using AutoCAD drawing and editing commands. The second portion of the course revolves around the design of welding fixtures. Topics include locating and clamping principles, basic construction principles, economics, introductory discussion of distortion and residual stresses, positioners, manipulators, power work holding, and modular work holding. A significant portion of the course involves the design of a welding fixture and implementing the use of (computer aided design) CAD drawings.

WE3014 Materials Preparation

This course introduces the student to the common edge preparation processes used in the welding industry. Practical application of oxy-fuel, plasma and mechanical edge preparations are compared on the basis of application and economics. Successful students will be able to select the most appropriate process in a given application. An overview of manufacturing processes including casting, forging, stamping, hot/cold forming, powder metallurgy etc. are emphasized in this course.

Semester 3

General Education Elective

General Education Courses are selected online each semester by the student from a list provided and exposes students to a related area of study outside of their immediate academic discipline. Certain programs have predetermined electives.

MA3033 Mathematics III

MA3033 focuses on additional topics in algebra, geometry and trigonometry. Applications from many fields of technology are explored to show where and how mathematical techniques are used in the real world. Emphasis is placed on doing mathematics. The learner is expected to apply time and effort to understanding the basic concepts. The learner is also expected to apply time and effort in demonstrating acquired knowledge by solving basic word problems involving technical applications. Using mathematics effectively in everyday situations requires the ability to apply a wide variety of mathematical skills accurately. Students who successfully complete this course will have demonstrated their ability to apply the concepts of number and space to situations which include quantities, magnitudes, measurements, and ratios. They will have developed their ability to identify the need for mathematics, to apply mathematical techniques (concepts, conventions, strategies, and operations) and to check the results of their analyses. This will require flexibility, creativity and confidence which can only be gained through practice.

Elements of the Performance include:

- Recognize real-life problems that require mathematics to solve
- Assess potential mathematical strategies (including models, geometric representations or formulae, elementary algebraic equations, descriptive statistical methods, and mathematical reasoning) for suitability and effectiveness
- Decide on the degree of accuracy required for answers
- Estimate probable answers
- Execute mathematical operations necessary to implement selected strategies
- Use calculators or appropriate technological tools to perform mathematical operations accurately
- Check for errors in numerical answers and the appropriate fit between problems and answers
- Express answers clearly
- Transfer the use of mathematical strategies from one situation to another

WE3044 Strength of Materials I

This course examines the behaviour of engineering materials under various loading conditions. The concepts of stress and strain are critically examined with emphasis on the application of those concepts to practical design and analysis problems. Topics include direct normal and shear stresses; axial deformation and thermal stress; torsional shear stress and torsional deformation; shearing forces and bending moments in beams; pressure vessel stresses; welded and bolted (riveted) connections.

WE3104 Engineering Materials II

This is a continuation of Engineering Materials I. This course studies a vast complement of common industrial materials, describing their respective micro-structures and properties based on fundamentals of atomic bonding, phase transformation and strengthening mechanisms. Processes such as heat treatment and mechanical working are dealt with from the theoretical as well as the practical aspect. Course topics include:

Fe-Fe₃C phase diagram, IT and CT diagrams, phase transformations, micro-structural and property changes of Fe-C alloys, Heat Treating, precipitation hardening, micro-structural and mechanical properties of ferrous and nonferrous metals, ceramics, polymers, composites, and corrosion.

WE3112 Materials and Processes

This course provides students with an introduction to Non Destructive Testing (NDT), an overview of the relevant materials science, as well as an understanding of the various industrial manufacturing processes used in Canada

today. Defects associated with these processes are discussed as well as the human factors associated with NDT. The codes and standards that apply in North America are also reviewed with special attention to Natural Resource Canada's NDT personnel certification scheme.

WE3113 Magnetic Particle Testing

This course is designed to give the student a basis for the evaluation of varied materials using the magnetic particle inspection method. Upon completion of the course the student will be able to explain the principles of magnetic particle inspection, and describe the equipment and procedures commonly used. The student will describe the merits and limitations of this inspection method and select the appropriate method for the type of component inspected and the discontinuities anticipated.

WE3123 Liquid Penetrant Testing

This course is designed to give the student a basis for the evaluation of varied materials using the liquid penetrant inspection method. Upon completion of the course the student will be able to explain the principles of liquid penetrant inspection, and describe the equipment and procedures commonly used. The student will describe the merits and limitations of this inspection method and select the appropriate method for the type of component inspected and the discontinuities anticipated.

WE3204 Welding Processes I

In this course, students are introduced to the various types of welding power sources, wire feeders and welding guns. Extensive use of a data acquisition system allows students to understand and apply static and dynamic power source characteristics for the short circuit GMAW process. This course also deals with the flux cored and gas metal arc welding processes. Students are expected to set up and demonstrate the safe use of FCAW and GMAW equipment. Data collected during lab sessions is used to complete comprehensive technical lab reports

WE4004 Welding Processes II

This course introduces students to the submerged arc and gas tungsten arc welding processes. Electric resistance welding is also included with emphasis on spot welding. Students are expected to demonstrate the proper set up and safe use of SAW, GTAW and ERW equipment. Students will learn how to document welding procedure specifications and qualification records.

Semester 4

BU1363 Introduction to Business Concepts

In this course, students will be introduced to business in Canada, focusing on introductory topics for those interested in employment in a business management role. Topics of study will include the relationships

between the areas of finance, human resources, marketing, and operations within an organization, business ethics and social responsibility, management concepts and practices, and an exploration of the entrepreneurial spirit.

WE4004 Welding Processes II (continued)

This course introduces students to the submerged arc and gas tungsten arc welding processes. Electric resistance welding is also included with emphasis on spot welding. Students are expected to demonstrate the proper set up and safe use of SAW, GTAW and ERW equipment. Students will learn how to document welding procedure specifications and qualification records.

WE4024 Welding Metallurgy I

The metallurgical aspects of the welding processes are studied. The interaction between heat source, structure and properties of welds is studied in greater depth. Weld ability of different materials (steel, stainless steel, cast iron, aluminum, polymers) is also discussed.

WE4073 Radiographic Inspection

This course is designed to give the student a basis for the evaluation of varied materials using the radiographic testing method. Upon completion of the course the student will be able to explain the principles of radiographic inspection, and describe the equipment and procedures commonly used. The student will describe the merits and

limitations of this inspection method and select the appropriate method for the type of component inspected and the discontinuities anticipated.

WE4083 Ultrasonic Inspection

This course is designed to give the student a basis for the evaluation of varied materials using the ultrasonic testing method. Upon completion of the course, the student will be able to explain the principles of ultrasonic testing, and describe the equipment and procedures commonly used. The student will describe the merits and limitations of this inspection method and select the appropriate method for the type of component inspected and the discontinuities anticipated.

Co-Op Work Terms

WE3010 Work Term I (Co-op)

Students completing the co-op program for Welding Engineering Technology Advanced Diploma will complete work terms during each of the three years of the program. Co-operative education is a proven, realistic and practical method of career education. Co-op will assist students in relating theory to practice, bringing more meaning to academic studies. Co-op helps orient students to their chosen field, enables them to learn and results in a well-developed career plan before graduation.

WE5010 Work Term II (Co-op)

Students completing the co-op program for Welding Engineering Technology Advanced Diploma will complete work terms during each of the three years of the program. Co-operative education is a proven, realistic and practical method of career education. Co-op will assist students in relating theory to practice, bringing more meaning to academic studies. Co-op helps orient students to their chosen field, enables them to learn and results in a well-developed career plan before graduation.