National Occupational Standard for

Instrument Technician

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2 A COMPETENCY FRAMEWORK FOR INDIVIDUALS WORKING IN THE BIO-ECONOMY

2.1 What is a National Occupational Standard?

In Canada, National Occupational Standards are industry-developed and validated documents that identify and group tasks/competencies associated with a particular occupation. They also describe the knowledge and skills that a worker must demonstrate to be considered competent.

The former Alliance of Sector Councils (TASC) outlined 11 guiding principles for creating National Occupational Standards (NOS). NOS for the Canadian bio-economy meet all 11 principles and are developed to meet the current and future human capital management needs of the Canadian bio-economy.

2.2 How are we defining a competency?

We define a competency as *a set of related behaviors that describe successful performance in a designated area. It is a behavioural expression of how people integrate knowledge, skills, attributes, and attitudes to produce a value-adding result in a defined situation.*

The competency statement includes a description that integrates skills, knowledge, and actions into a sequence of activities that deliver a value-added product or service.

Performance Indicators is the term we use for the behaviours grouped under each competency that describe the level of mastery the incumbent role must demonstrate when executing a task.

For this project, we have organized the competencies into four categories.

Core Competencies are those competencies that describe the "essence of the role" — that is, they are the one to three most critical competencies that may be applicable across multiple roles in a function or job family. All levels of personnel in this function would typically share them. These competencies may also act as qualifiers that differentiate the function from other functions.

Technical Competencies are those competencies related to specific roles or professions that enable an individual to work, function, and succeed in that role. They address the various responsibilities that job incumbents encounter in a role. For example, a surgeon's technical competencies would encompass multiple surgical tools, techniques, and conditions that could be part of the position. Similarly, technical competencies for a lawyer would contain various legal situations that they encounter in the context of a particular field of practice.

Regulatory Competencies are those competencies that describe compliance with prescribed practices and mandated obligations under applicable laws, regulations, and industry standards. They ensure that critical work processes are implemented and integrated into all work activities. They are of absolute importance where economic behaviours can impact human conditions.

Personal/professional Competencies are those competencies that enable an individual to be successful working with others and fulfilling their responsibilities in a work context. Personal and professional competencies are not necessarily role specific.

2.3 Levels of complexity of work

It is important to recognize how the complexity of work varies along an organizational continuum. At one end of this continuum is low-complexity, clearly-defined, task-driven work. At the other end of the continuum is work that is higher in complexity, not as well-defined, and requires higher-level thinking and decision-making skills and a greater degree of autonomy. Results are recognised over a longer period of time and are more difficult to assess.

Figure 1: Demonstrates how the level of complexity changes with the role responsibilities

Complexity Level	Examples of Work at Different Complexity Levels	Typical Roles/Titles
Most Complex	Construct and pursue worldwide strategic plans in large corporations.	CEOs of the largest trans-global corporations
	Construct and pursue worldwide strategic plans.	C-suite executives at multi-national organizations
	Lead the accumulated impact of multiple business units.	C-suite executive at large, multi-location organizations
	Optimize the function of a single business unit or corporate support staff.	General manager; plant manager
	Manage multiple, interdependent projects; balance resources among departments.	Engineering manager
	Plan and carry out sequential projects while considering contingencies and alternatives.	Maintenance manager
	Accumulate information to diagnose and anticipate problems; proactive; notice trends.	Maintenance technician
Least Complex	Follow predefined procedures; seek help when encountering an obstacle. The ability to anticipate problems is not expected.	Maintenance labourer

We define the complexity levels within the profiles at four levels:

Foundational — performance focus is on the execution of procedures and tasks involving own job role.

Operational — performance focus includes some discretion in the planning and executing of work. The work typically includes assessing the quality of the work outcomes and taking corrective action to ensure quality.

Specialist — performance focus is on translating goals and standards to team members and ensuring that work done under the person's responsibility area complies with all corporate standards.

Strategic — performance focus is on leading work and the accumulated impact of work in an independent business unit or across a whole organization. The impact of work at this level is often not visible until the medium to longer term.

The following example illustrates the different complexity levels within a profile.

Competency Name: Research Ethics			
Competency Definition: Exercises integrity and professionalism to ensure all research is performed responsibly in keeping with the ethical principles of beneficence and nonmaleficence.			
Competence at this level is demonstrated when the **Research Manager**:			
Performance Indicators			
Foundational	Operational	Specialized	Strategic
Diligently follows research procedures and protocols mandated by legitimate authorities and professional organizations.	Regularly monitors own actions and decisions to ensure they align with professional and organizational values.	Holds self and staff accountable to the organization's values, ensuring compliance with the policies and procedures related to scientific ethics and rules of conduct.	Fosters an organizational culture of integrity and ethical business practices by unwavering personal example.

2.4 Overview methodology for the development of national occupational standards

National occupational standards were developed using a multi-step process.

Step	Description	Result/Output
1	Identify critical roles in the bio-economy through primary and secondary research.	List of 50 key roles
2	Create draft profiles with critical competencies for the roles, performance, and knowledge indicators.	Draft profiles
3	Review the draft profiles with industry subject matter experts to refine the competencies, performance, and knowledge indicators.	Reviewed profile with design inputs from industry experts
4	Further validation and review by industry via online focus group.	Validated profiles by industry experts
5	Broader validation of the draft profiles via national online surveys.	Occupational Standards validated on a national level by experts from the different sectors
6	Addition of the Essential Skills and Canadian Language Benchmark (ES/CLB) ratings.	Nationally validated NOS profiles with ES/CLB profile for each NOS

3 INSTRUMENT TECHNICIAN COMPETENCY FRAMEWORK

3.1 Competency diagram Instrument Technician

Competencies		Complexity Level				Complexity Level Legend
		1	2	3	4	1. Foundational
Core Competency						
1	Data Management		▓			2. Operational
2	Instrument Installation		▓			
Technical Competencies						3. Specialist/Manager
3	Instrument Handling		▓			
4	New Concepts Development		▓			4. Expert/Executive
5	Instrument Testing		▓			
6	Troubleshooting		▓			
7	Instruments Maintenance		▓			
8	Instruments Repairing		▓			
9	Risk Assessment		▓			
10	Safety Compliance		▓			
11	Process Documentation		▓			
12	Information Reporting		▓			
Industry Regulatory Competencies						
	Included in Technical Competencies		▓			
Personal and Professional Competencies						
13	Attention to Detail		▓			
14	Problem Solving		▓			
15	Communication		▓			
16	Teamwork		▓			

3.2 Definition of occupation

The Instrument Technician installs, tests, maintains, and repairs low-voltage and low-pressure mechanical and electrical systems, including robotic and information technology systems, as well as safety, security, and communications systems. They also install and service instruments to monitor processes and equipment.

The Instrument Technician works with pneumatic, electronic, and microcomputer devices used to measure and control pressure, flow, temperature, level, motion, force, electrical signals, and chemical composition. They are responsible for inspecting, testing, calibrating, installing, and repairing these devices, and work with others to develop standard operating procedures (SOPs) and to ensure regulatory compliance.

They may serve as a point of contact for the media and represent their organization at industry forums and events:

Applicable To	Bio-Health	Agri-Bio	Bio-Industrial	Bio-Energy
	■		■	■

The level of complexity of the role is:

Span of Complexity Levels	Foundational	Operational	Specialist/ Management	Expert/Executive
		■		

3.3 Level of education, training or designations requirements

Typical Education Required	Secondary	College	Bachelor	Master	PhD
		■	■		
Typical Starting Experience	0–5 yrs.	5–10 yrs.	10–15 yrs.	15–20 yrs.	20+ yrs.
	■				

- Completion of post-secondary degree is required by most organizations
- Trade certification as Industrial Instrument Service Technician or Instrumentation and Control Technician is available, but voluntary, in all provinces and territories, except in Quebec
- Completion of an apprenticeship program in industrial instrument repair or a college program in industrial instrumentation technology combined with work experience is usually a requirement for trade certification
- Aptitude for math, problem-solving, mechanics, troubleshooting, and computer software

3.4 Core competencies list for Instrument Technician

3.4.1 Data Management

Implements Standard Operating Procedures (SOPs) relating to the collection of data, data capturing, data analysis, and access to the data in order to facilitate management's decision-making.

Competency in this role is demonstrated when the individual:

- Reviews production reports/shift logs to aid in efficient operations.
- Reads and interprets work orders, assembly drawings, blueprints, circuit diagrams, and schematics to determine tests and maintenance procedures for instruments used for measuring and controlling flow, level, pressure, temperature, chemical composition, and other variables.
- Creates/updates instrument inventory (name, serial number, location, manufacturer details, etc.) to manage the equipment effectively.
- Ensures that all data relevant to the instrument is captured, entered, controlled, validated, and documented according to SOPs to ensure the instrument is in good working condition.

Knowledge required for competency at this level:

- Knowledge of data gathering and representation techniques
- Working knowledge of data analysis models and tools (selection depends on the types of data collected)
- Understanding of information documentation, recording, and reporting
- Knowledge of applicable ISO standards

3.4.2   Instrument Installation

Installs and programs control and measurement instruments on existing and new equipment to improve productivity within the company as per manufacturer and company requirements.

Competency in this role is demonstrated when the individual:

- Checks electrical requirements, physical space needed, etc., and identifies out-of-the-ordinary conditions in order to ensure proper instrument installation.
- Identifies installation, calibration, and maintenance requirements (e.g., tools, spare parts to stock, etc.) in order to meet supplier and company specifications.
- Advises team members about the timing of installation to minimize interference with production during installation.
- Identifies and collaborates with additional stakeholders and personnel to ensure a smooth and safe installation (including pre- and post-installation requirements).

Knowledge required for competency at this level:

- Knowledge of relevant occupational health and safety (OHS) regulations
- Knowledge of manufacturer safety procedures and standards for the instrument installation
- Knowledge of organization's internal safety procedures and standards for proper installation

3.5 Technical competencies list for Instrument Technician

3.5.1   Instrument Handling

Moves, stores, controls, and protects the instrument in order to maintain/improve instrument quality and working conditions; reduce damage; promote safety, productivity, and use of facilities; and control inventory.

Competency in this role is demonstrated when the individual:

- Ensures self and others use safe lifting and handling techniques according to OHS standards and adhere to SOPs to avoid work related injuries.

- Assesses safest and most efficient way to move materials and instruments to the appropriate destination(s) to ensure workplace safety.
- Ensures the availability of the material/instruments for proper installation, calibration, and maintenance.

Knowledge required for competency at this level:

- Knowledge of proper use, maintenance, and storage requirements for instrument's individual component characteristics
- Knowledge of inventory control methodologies
- Knowledge of manual handling techniques
- Knowledge of safe work practices and procedures
- Understanding of proper handling and storage of materials and waste disposal

3.5.2 New Concepts Development

Assists in preparation of instrument specifications, generating the need/concept of a new instrument or system from process design to prototype development to final product in order to answer technical challenges and meet new standards.

Competency in this role is demonstrated when the individual:

- Assists in the preparation of engineering designs and instrument specifications and/or modification of the existing ones in order to develop/modify continuous testing methods/procedures.
- Plans/sets up/conducts lab performance/evaluation tests of prototypes of instruments.
- Checks out the new instrument before operations commence to ensure that the standards remain within the required operations.
- Assists in developing maintenance standards, schedules, and programs to ensure optimum operation of instruments and systems.

Knowledge required for competency at this level:

- Knowledge of changing business requirements
- Knowledge of instrument SOP
- Knowledge of Systems Development Life Cycle (SDLC)

- Understanding of continuous testing system requirements
- Knowledge of documentation techniques
- Knowledge of Design for Manufacturing (DFM)

3.5.3   Instrument Testing

Verifies instrument performance to determine if it is operating correctly and to ensure the instrument's reliability and capability of operating at acceptable performance levels.

Competency in this role is demonstrated when the individual:

- Inspects instrument components to ensure compliance with manufacturer instructions/specifications.
- Assists with the inspection of instrument and controller assembly to ensure proper installation.
- Examines instrument to check for cleanliness, stains, corrosion, cracks, breakage, and stiffness of movable parts to except any problems during the operation.
- Uses pneumatic, electrical, and electronic testing devices to test instrument and system operations and diagnose faults.
- Performs a multi-point verification/calibration to ensure the instrument is within acceptable calibration requirements before use (if the instrument was disassembled after manufacturer calibration or no calibration of the instrument had previously been performed).

Knowledge required for competency at this level:

- Ability to perform instrument inspection
- Knowledge of quality controls for testing and installing instrument
- Understanding of inspection plans and acceptable quality limit
- Basic knowledge of Geometric Dimensioning and Tolerancing (GD&T)
- Knowledge of instrument SOP

3.5.4   Troubleshooting

Identifies and analyzes problems by determining whether or not they can be repaired, what is needed to repair them, and how long it will take to make the instruments operational again. In the case of significant issues, refers to the maintenance team (internal maintenance or external supplier or manufacturer) to ensure efficient repairs.

Competency in this role is demonstrated when the individual:

- Inspects the instrument and uses appropriate tools to make sure the instrument meets all design parameters of the specifications.
- Identifies the source of failure to enable effective corrective action.
- Checks all tasks that have been affected by the failure, once the instrument is operational again.
- Troubleshoots, repairs, and if necessary, retires the instrument, considering any potential hazards and following all safety disposal procedures.
- Contacts the appropriate authority if the failure of the instrument in part or whole is pointing to significant operational issues.
- Ensures that all data relevant to the failure of the instrument or the part is documented and reported to stakeholders accordingly.

Knowledge required for competency at this level:

- Practical knowledge regarding the instrument that the technician provides support for and its common use cases
- Technical knowledge related to the instrument
- Knowledge of various problem-solving techniques

3.5.5   Instruments Maintenance

Conducts Preventive Maintenance (PM) to lessen the likelihood of instrument breakdowns, accidents, and the costs associated with each, and to prolong the life and proper operation of the instrument.

Competency in this role is demonstrated when the individual:

- Provides recommendations relating to established goals (such as reducing downtime, increasing reliability, cutting costs) and implements plans to achieve those goals.

- Diagnoses faults using pneumatic, electrical, and electronic testing devices, and includes the most critical assets in the PM plan.
- Reviews instrument manufacturer recommendations to help determine the appropriate timing of PMs.
- Analyzes maintenance history to determine optimal PM priority and schedule.
- Makes minor repairs/adjustments to the instrument and system components (sensors, transmitters, etc.) and contacts an industrial mechanic as needed for large repairs.
- Creates/updates an instrument maintenance log, adding information about the work that was done on the equipment (e.g., date of calibration, date and brief description of maintenance task, time of the next scheduled maintenance, additional observations, notes, or comments).
- Performs validations and ensures the PM results are documented and reported in order to aid decision-making.

Knowledge required for competency at this level:

- Understanding of the principles of Mean Time Before Failure (MTBF) and Mean Time Before Replacement (MTBR)
- Knowledge of instrument manufacturer guidelines and recommendations for safe operations and preventative maintenance processes, including uses of maintenance tracking software and/or procedures

3.5.6   Instruments Repairing

Carries out repairs in accordance with manufacturer specifications in case of instrument and/or system component failure in order to minimize downtime and maintain productivity.

Competency in this role is demonstrated when the individual:

- Provides recommendations relating to established goals (reducing downtime, increasing reliability, cutting costs, etc.), identifies the cause of failure, and determines the necessary steps to repair the instrument.
- Localizes, isolates, and removes the failed instrument or its system component for disposal or repair, following safety protocols.
- Replaces the disposed of instrument or installs a new component, contacting the maintenance team if needed.
- Reassembles, realigns, or adjusts the instrument after the repair, and calibrates to ensure it is working properly.
- Tests the repaired instrument or system component before being put back to use in order to prevent a possible future failure.
- Ensures the repair and results are documented/reported/filed/retained for further potential repairing purposes.

Knowledge required for competency at this level:

- Understanding of the principles of Mean Time Before Failure (MTBF) and Mean Time Before Replacement (MTBR)
- Knowledge of manufacturer specifications for instrument being repaired
- Knowledge of maintenance tracking software and/or procedures

3.5.7   Risk Assessment

Assists engineers and/or occupational health professionals in performing risk assessments to recognize and control potential hazards in the workplace and mitigate risk and impact.

Competency in this role is demonstrated when the individual:

- Assists in risk categorization (technical, operational, logistics, environmental, or safety) to determine the areas that are the most exposed to the effects of risks.
- Assists in the identification of risk associated with instrument operation in order to develop mitigation and management plans.
- Assists in mapping out the social scope of risk management, defining a framework for the activity and a plan for identification.
- Participates in developing an analysis of risks involved in the process in order to identify existing and potential threats.
- Assists in risks estimation, using available technological and organizational resources to calculate both the likelihood of threats being realized and their possible impact.

Knowledge required for competency at this level:

- Knowledge of risk management tools
- Knowledge of instruments SOPs
- Knowledge of OHS regulations

3.5.8   Safety Compliance

Ensures own and others' safety by following safety policies and procedures in order to eliminate workplace hazards and maintain a safe work environment.

Competency in this role is demonstrated when the individual:

- Inspects, operates, and maintains tools and instruments as per manufacturer recommendations and established company policies to ensure that they are in a proper operating condition and meet safety requirements.
- Becomes familiar with applicable work procedures before the start of work and participates in appropriate training to work safely with the instruments and power tools and to ensure their proper usage and eliminate potential injuries.
- Labels products according to WHMIS standards to be able to return/store materials in their designated area.
- Reports identified safety hazards to designated personnel following workplace requirements and relevant workplace OHS legislation.
- Uses OHS procedures and follows all safety rules, regulations, and accident/incident reporting procedures as per company policy for controlling hazards/risks in the workplace.

Knowledge required for competency at this level:

- Knowledge of OHS procedures and legislation relevant to the workplace
- Knowledge of accident and emergency procedures as per company policy
- Knowledge of company's safety training requirements
- Knowledge of [roper use, handling, storage, and disposal procedures for instruments and materials
- Knowledge of SOPs for the instrument(s) and Safe Work Procedures (SWP)

3.5.9   Process Documentation

Provides a detailed description of how to carry out instrument operations in order to help optimize workflows and processes, train employees, preserve company knowledge, mitigate risks, and maintain operational consistency.

Competency in this role is demonstrated when the individual:

- Compiles/documents information on company policies, checklists, tutorials, forms, screenshots, links to other applications, and process maps in order to understand/support the processes.
- Keeps the record concise, straightforward, and technically accurate to ensure it is easy to understand and follow.
- Updates documents to ensure all process changes have been captured.
- Maintains separate documentation for every different process to avoid confusion.

- Stores the materials in a location or on an online platform via a process documentation tool using appropriate examples, graphics, colour coding, screenshots, multiple platforms, etc. to make sure that the information can easily be accessed and understood by relevant stakeholders
- Makes sure the process documentation complies with existing standards of the organization to help to preserve company knowledge and improve processes.

Knowledge required for competency at this level:

- Knowledge of process documentation methods/tools

3.5.10 Information Reporting

Takes information and presents it objectively and concisely to inform colleagues, supervisors, and other stakeholders about instrument installation, testing, calibration, quality inspection, maintenance, repairing, safety, etc.

Competency in this role is demonstrated when the individual:

- Prepares reports to inform stakeholders about installation, calibration, testing, instrument maintenance, deviations, and out of tolerance incidents.
- Follows accident/incident reporting procedures as per company policy to prevent further injuries or damage.
- Completes quality inspection reports to note that inspections were performed and highlight product and safety deficiencies.
- Completes downtime reports to explain the cause of delays.
- Contributes to the development and implementation of policies/procedures/work instructions to reduce training time/costs.

Knowledge required for competency at this level:

- Understanding of technical report writing

3.6 Industry regulatory competencies list for Instrument Technician

Included in Technical Competencies.

3.7   Personal and professional competencies list for Instrument Technician

3.7.1   Attention to Detail

Ensures information is complete and accurate and follows up with the team, internal, and external stakeholders to ensure that the job requirements have been fulfilled.

Competency in this role is demonstrated when the individual:

- Follows process steps as outlined in SOPs to ensure the process accuracy.
- Reviews materials to ensure they are accurate, clear, and concise.
- Monitors and checks the work/information while organizing time and resources for efficient task completion.
- Brings together different elements to achieve results or accomplish tasks.
- Performs follow-up to ensure the information and quality of work product or actions are completed and accurate.

Knowledge required for competency at this level:

- Knowledge of relevant SOPs

3.7.2   Problem Solving

Understands a work-related problem or situation, acts to address inconsistencies in ongoing operations, and successfully resolves problem situations.

Competency in this role is demonstrated when the individual:

- Breaks down the problem into smaller and simpler parts to get a clearer idea of how to solve the problem.
- Reorganizes the elements of a problem or situation in a systematic way to get a better understanding of the problem and aid in generating solutions.
- Finds additional relevant information that can help to resolve a problem or situation.
- Makes logical comparisons of different features/aspects, sets priorities on a rational basis, and identifies time sequences to discover cause and effect relationships.

- Implements and follows up with the solution to ensure effective and timely resolution of the problem.

Knowledge required for competency at this level:

- Knowledge of root cause analysis techniques

3.7.3   Communicaton

Positively directs outcomes by delivering communication that results in a better understanding of goals and objectives and that captures interest and gains support for immediate action.

Competency in this role is demonstrated when the individual:

- Successfully interacts with a wide range of people professionally and ethically, and communicates technical information clearly and concisely.
- Uses appropriate communication channels and methods for communicating with coworkers, supervisors, and other stakeholders.
- Discusses ongoing work with coworkers during shift changes to ensure production continues smoothly.
- Participates in safety meetings and training, daily production talks, and safety sessions to learn about work assignments.
- Informs team members of the timing and the progress of the installation/work.
- Writes logbook entries and short notes (what happened during shifts, record errors, and damages) for coworkers and other stakeholders, as required.

Knowledge required for competency at this level:

- Knowledge of effective communication models

3.7.4   Teamwork

Interacts with supervisors/lead hands and colleagues by participating actively and contributing to the capability of the team to achieve shared goals in a safe and efficient manner.

Competency in this role is demonstrated when the individual:

- Communicates in an honest, respectful, and sensitive manner, demonstrating mature, respectful, fair, and equitable behaviours in all interactions and situations.
- Participates in formal discussions about work processes or product improvements and offers ideas or suggests modified approaches that may provide improvements.
- Provides and receives feedback from others and engages in continuous improvement.
- Behaves professionally by being punctual, reliable, and understanding personal responsibility, contribution, and role.

Knowledge required for competency at this level:

- Understanding of professional's roles and ethics
- Knowledge of conflict resolution techniques

3.8 Essential Skills for Instrument Technician

Essential Skills (ES) are foundational skills required for all types of work. They are not technical skills, but the core skills people need to acquire knowledge and complete workplace tasks and daily activities.

Understanding the ES requirements for a role can allow individuals to compare their skills to those required, assist training/learning providers in developing appropriate supports to ensure ES levels are developed during training, and provide employers with an additional tool for determining who/how to place in particular roles.

Human Resources and Skills Development Canada has defined Essential Skills as follows:

- Reading
- Document Use
- Numeracy, which is further divided into:
  o Money math; Scheduling, budgeting, and accounting math; Measurement and calculation math; Data analysis math.
  o Several different factors related to estimations, including the presence of a set procedure, the number of items being estimated, the consequences of errors in estimation, the amount of information missing, and the accuracy required.
- Writing

- Oral Communication
- Thinking Skills, which are further divided into:
  o Problem Solving
  o Decision Making
  o Critical Thinking
  o Job Task Planning and Organizing
  o Finding Information
  o Significant Use of Memory
- Digital Skills
- Working with Others
- Continuous Learning

Most of the ES have levels based on complexity, and a role can be analyzed to determine the appropriate levels of ES. The exceptions are noted below:

- "Working with Others" does not have a complexity rating: it simply describes the ways in which the role would be required to interact with other people, either internally within the organization or externally (i.e., with clients, customers, or the public).
- "Continuous Learning" does not have a complexity rating: it describes the types of learning expected in the context of the role (e.g., on the job, being mentored by others, formal training as part of the job, etc.).

NOTE: as of January 2020, ESDC was undertaking a comprehensive review of ES with the intent of adding additional skills, refining existing ones (particularly digital skills) and better aligning ES with similar approaches used in other countries. However the detail was not finalized in time to be used, therefore the profiles developed for this project follow existing standards as of December 2019.

3.9 Canadian Language Benchmark for Instrument Technician

Canadian Language Benchmarks (CLB) are a 12-point scale for task-based language proficiency descriptors which were originally developed as a guide for measuring the teaching and assessment of English as a Second Language (ESL) learners in Canada. Since they

were originally developed, the Canadian Centre for Language Benchmarks (CCLB) has continued to refine CLB, and it now includes scales for both English and French language proficiency. [1]

The CLB has been validated against both the Common European Framework for Language (CEFL) and the American Council for the Teaching of Foreign Languages (ACTFL) benchmarks and is considered accurate for high-stakes evaluation[2].

The ES levels for Oral Communication were developed with reference to the Canadian Language Benchmarks[3]. Comparative work to determine the alignment between the CLB and other Essential Skills has been ongoing, with recent work providing additional alignment with the ES for Oral Communication in both spoken and listening domains, Reading, Writing, and Document Use.[4]

CCLB has developed a set of crossover tables that align CLB ratings with ES ratings for reading, writing oral communication and document use.

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[1] Centre for Canadian Language Benchmarks. Theoretical Framework for The Canadian Language Benchmarks And *Niveaux De Compétence Linguistique Canadiens.* CCLB. Ottawa 2015. p8
[2] Centre for Canadian Language Benchmarks. Canadian Language Benchmarks: English as a Second Language for Adults, CCLB. Ottawa 2012 p.II
[3] Essential Skills Research Group. Readers Guide to the Essential Skills. ESDC. Ottawa ND. p57
[4] Canadian Centre for Language Benchmarks. Relating Canadian Language Benchmarks to Essential Skills: A Comparative Framework. 2015, p3

Instrument Technician ES/CLB Profile

Essential Skills	Equivalent CLB Level	ES Level				
Reading	Reading: 7–9	1	2	3	4	5
Document Use	Reading: 7–8 Writing: 7–8	1	2	3	4	5
Writing	Writing: 8	1	2	3	4	5
Oral Expression	Speaking: 9–10 Listening: 9–10	1	2	3	4	
Numeracy	n/a	1	2	3	4	5
Thinking Skills – Problem Solving	n/a	1	2	3	4	
Thinking Skills – Decision Making	n/a	1	2	3	4	
Thinking Skills – Job/Task Planning and Organizing	n/a	1	2	3	4	
Thinking Skills – Significant Use of Memory	n/a	Types 1,2,3				
Thinking Skills – Finding Information	n/a	1	2	3	4	
Digital Skills	n/a	1	2	3	4	5
Working with Others	n/a	See Below				
Continuous Learning	n/a	See Below				

Explanation of the Essential Skills and the Canadian Language Benchmark for Instrument Technician

Reading: ES 3 CLB: 7–9

Instrument Technicians read and interpret scientific and technical publications and reports related to the set-up, calibration, operation, and maintenance of measurement and control devices used in research and production environments. These include project reports, maintenance records, and other engineering and technical documentation.

Document Use: ES 3 CLB: Reading: 7–8, Writing: 7–8

Instrument Technicians access and interpret information from a variety of different paper and electronic documents. Sources are known and the type of information is generally usable without translation or interpretation. Information may be textual, graphical, numerical, or even handwritten in nature.

Writing: ES 3 CLB: 8

Instrument Technicians prepare written responses to routine inquiries from stakeholders and compose messages to convey detailed instructions, processes, and other complex information. They draft reports for others and are also involved in transmitting information internally in writing, so accuracy and comprehension is important. During experiments, they document steps and procedures so the experiment can be replicated by others. Instrument Technicians may contribute to the development of training content and SOPs for conducting research and using specific tools, equipment, materials, or processes. This material must be used by others.

Oral Expression: ES 3 CLB: Speaking: 9–10, Listening: 9–10

Instrument Technicians converse with peers, more senior staff, and support personnel in the course of their work. They may be involved in coaching/mentoring more junior personnel. These conversations range from the routine and non-technical (scheduling, administrative tasks) to highly complex discussions of technical and scientific information. They must employ effective listening techniques to ensure clarity and comprehension.

Numeracy: ES 3 (Money Math: n/a, Scheduling, Budgeting and Accounting: n/a, Measurement & Calculation: 3, Data Analysis: 3)

Instrument Technicians perform basic calculations using standard formulae with known variables. They calibrate equipment using mathematical approaches to ensure accurate measurement, and may perform analysis on experimental results data to determine if

equipment is operating within acceptable tolerances. Most calculations are conducted using established formulae or algorithms, and while specialized software may be used to assist, it is important that they understand the underlying math in order to recognize and troubleshoot incorrect results.

Thinking Skills:

Thinking skills are subdivided into five domains:

- Thinking Skills — Problem Solving

- Thinking Skills — Decision Making

- Thinking Skills — Job/Task Planning and Organizing

- Thinking Skills — Finding Information

- Thinking Skills — Significant Use of Memory

- **Thinking Skills — Problem Solving: ES 2**
Instrument Technicians solve routine problems related to the set-up, calibration, operation, and maintenance of control and measurement equipment in labs and production environments. There are a limited number of parameters to consider, and the relationships between different parameters are generally clear. They may occasionally need to design an approach to solving unique problems, but in these cases they will have assistance from more senior technical/engineering personnel.

- **Thinking Skills — Decision Making: ES 2**
Instrument Technicians make routine decisions within defined parameters as part of their day-to-day work. These decisions generally have immediate impact, and incorrect decisions can be corrected and reversed with some difficulty, cost, or inconvenience, but will rarely have long-lasting egregious consequences for the organization.

- **Thinking Skills — Job/Task Planning and Organizing: ES 2**

Instrument Technicians plan their own work within specified operational and administrative parameters. They have some discretion over the work they do within the general practices of their trade/occupation. They may be required to coordinate activities with others, particularly where resources are shared between individuals or projects.

- **Thinking Skills — Finding Information: ES 2**

Instrument Technicians use known sources to gather the information they require for the performance of their jobs. Usually the information is in an 'end-use' state when they find it and can be used immediately without further interpretation.

- **Thinking Skills — Significant Use of Memory: Types 1, 2, 3**

Instrument Technicians are required to memorize, retain, and use project-specific information through one or all of the following methods:

- Purposeful memorization of procedures, codes, parts numbers, memorization through repetition (Type 1)
- Remembering information for brief periods, e.g., minutes or hours (Type 2)
- Unique events in which learning occurs from exposure (Type 3)

Digital Skills: ES 3

Instrument Technicians use computers and the Internet in the course of their duties. This can involve entering and analyzing data in specialized software systems. They use general office software (Microsoft Office) as well as specialized software appropriate to specific projects. They also input information and use reporting software to draw charts and graphs, or as part of the quality control program (flowcharts, check sheets, Pareto diagrams, cause and effect diagrams, histograms, scatter diagrams, control charts, etc.).

Working with Others: Work Contexts 2, 3 & 4

Instrument Technicians operate as part of a multi-disciplinary team under the direction of more senior technicians and managers. More experienced instrument technicians may supervise/instruct junior personnel and apprentices. The following work contexts and functions are relevant to the Instrument Technician role:

- Works independently (Work Context 2)
- Works jointly with a partner or helper (Work Context 3)

- Works as a member of a team (Work Context 4)

They may also be minimally involved in supervisory or leadership activities such as supervising the work of other technicians, coaching and performance development through the following: Functions 1, 2, 4, 5, & 9–11

- Participate in formal discussions about work processes or product improvement (S/L Function 1)
- Have opportunities to make suggestions on improving work processes (S/L Function 2)
- Inform other workers or demonstrate to them how tasks are to be performed (S/L Function 4)
- Orient new employees (S/L Function 5)
- Assign routine or new task to other workers (S/L Function 9 & 10)
- Identify training that is required by or would be useful for other workers (S/L Function 11)

Continuous Learning: Types of Learning 1, 2, 3   How Learning Occurs: 1, 2, 3, 4, 5, 6
Instrument Technicians are required to maintain and upgrade their technical knowledge in order to remain employable. They must recognize personal knowledge gaps, and may undertake independent action to actively seek targeted opportunities to acquire new skills and knowledge. The following type of learning is essential to their role:

Type of learning may include:
- Training in job-related health and safety (Type 1)
- Obtaining and updating credentials (Type 2)
- Learning about new equipment, procedures, products, and services (Type 3)

The learning may occur:
- As part of regular work activity (Context 1)
- From coworkers (Context 2)
- Through training offered in the workplace (Context 3)
- Through reading or other forms of self-study, which may include (Context 4):
    - At work
    - On worker's own time
    - Using materials available through work

- o   Using materials obtained through a professional association or union
- o   Using materials obtained on worker's own initiative
- Through offsite training, which may include (Context 5):
  - o   During working hours at no cost to the worker
  - o   Partially subsidized
- With costs paid by the worker (Context 6)

4   REFERENCES

Gathering the data

The development of the National Occupational Standards started with a review of existing information for the role. This review process included: referencing books, job postings, websites, articles, and BioTalent Canada's existing skills profiles to create the first draft. After several iterations via written feedback, focus groups and a national survey with subject matter experts, the National Standards were developed. The following are sources consulted during the creation of the **Instrument Technician** profile:

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During the research period, several job posting boards were reviewed for this profile.

You already have a stellar team. Here's how to enhance their key skills.
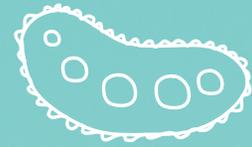
PROFESSIONAL DEVELOPMENT

- Essential Skills Fundamentals
  - Introduction to the Bio-economy, Reading, Writing, Numeracy, Document Use, Communication, Collaboration, Problem Solving

- Technical Skills Fundamentals
  - Scientific Report Writing, GLP, GCP, GMP, QA/QC

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