



Release Of Updated Apprenticeship Curriculum Standard	
Trade Name(s) and Code(s)	<ul style="list-style-type: none"> • 447A Instrumentation and Control Technician (ICT)
Implementation Date of New Standard	<ul style="list-style-type: none"> • September 1, 2017 - released as version 300
Implementation Plan	<ul style="list-style-type: none"> • The Ontario College of Trades (the 'College') is implementing a new curriculum standard for three levels of in-school training for 447A Instrumentation and Control Technician • There are no restrictions as to when TDAs must begin implementation of Level 1. The College advises an End Implementation Date for all three levels of 447A by January 1st, 2019. • It is expected that apprentices will advance through training without having to repeat any areas. • The EOIS-APPR has been updated to reflect the new curriculum standard.. • Apprentices who began their apprenticeship on the former 2008 Curriculum Standard can complete their program using that standard.
Impact on Training Standard	<ul style="list-style-type: none"> • The skills and competencies in the new Training Standard are aligned to the learning outcomes in the new curriculum standard.
Curriculum Standard Access	<ul style="list-style-type: none"> • The new Curriculum Standard will be made available on the Ontario College of Trades website.
Content Changes	<p style="text-align: center;">Level 1 Reportable Subject changes:</p> <ul style="list-style-type: none"> • Learning outcome renamed Learning outcome S3213.3 has been renamed Digital Circuits and Schematics to reflect current industry terminology. • Learning outcomes order Learning outcomes S3212.3 "Electrical Circuits" and S3212.4 "Electrical Control Devices" have been placed in a logical order in the Curriculum, they were in the opposite order in the old curriculum.



Level 1 Learning Outcomes Content Changes:	
	<p>S3211.2 Trade Standards and Codes</p> <p>2.1 and 2.2</p> <p>The term “Ontario Electrical Safety Code (OESC)” has been changed to “Canadian Electrical Code (CEC)” since Apprentices are taught using the CEC and not the OESC.</p> <p>S3211.3 Tools and Equipment</p> <p>General Learning Outcome</p> <p>Term “construction” has been removed since Apprentices do not build tools.</p> <p>3.1</p> <p>Term “hand” has been removed as there are many tools used in the trade who are not necessarily manual tools.</p> <p>S3211.4 Locking and Tagging Procedures</p> <p>Terms “Lock out and Tag Out” have been changed to “Locking and Tagging” to match terminology used in the industry as per OHS and most recent Training Standard.</p> <p>4.1</p> <p>Term “manufacturer’s recommendations” has been added as they are followed in locking in tagging procedures from time to time and depending on the equipment.</p> <p>The following content has been added, this is an important step previously missing in the locking and tagging procedures: “Describe how to re-energize the mechanical and electrical equipment according to applicable codes, manufacturer’s”.</p> <p>Term “hazard assessment” has been added as this is the primary step prior to start-up of any work.</p> <p>S3212.1 Electrical Fundamentals</p> <p>1.1</p> <p>Term “amperage” has been replaced by “current”. Amperage is a unit of power while current is the actual term used in industry.</p>



1.2

Term “energy” has been added as it is related to voltage and current.

Term “power and heat loss” has been removed as it is already covered by power and energy.

The following content has been removed, this is already covered under Health and Safety: “Describe the effects of electricity on the human body (visible and invisible effects)”.

S3212.3 Electrical Circuits

General Learning Outcome

Term “typical industry” has been replaced with “industrial”, this new term better reflects the type of scenarios to which Apprentices are exposed.

3.2

Bullet points’ content has been comprised in single sentences to avoid unnecessary repetition.

Term “draw” has been removed, it is not needed.

S3212.4 Electrical Control Devices

General Learning Outcome

Term “typical industry” has been replaced with “industrial”, this new term better reflects the type of scenarios to which Apprentices are exposed.

4.1

Term “Wheatstone bridge” and content related to this circuit for resistance measuring has been removed, this is not a control device.

Term “switches” has been added, this is a type of control devices

S3213.1 Electronic Fundamentals

1.4, 1.5 and 1.6

These bullet points have been added, the previous content has been re-arranged into individual points rather than a single one. This gives the instructor a more clear definition on the content to be reviewed.

S0372.2 Electronic System Test Equipment

The following content has been removed as it was added to S3213.1: “Use electronic test equipment to verify the operation of electronic circuits”.



S3213.3 Digital Circuits and Schematics

Term “electronic” has been replaced with “digital” throughout this unit, all content is based in digital components.

3.3

The content in this skill has been re-arranged.

S3214.1 Computer Fundamentals

1.1

Term “hard” has been replaced with “memory”, this term encompasses a broader group of memory devices that are used nowadays.

The following content has been removed: “Operate a microcomputer by utilizing fundamental commands necessary for the proper operation of modern computer software (Basic Input Operating Systems – BIOS and Operating Systems)”. All learning is computer-based nowadays

S3214.3 Computer Generated Documents

3.1

Term “and explain the function/operation of work” has been removed, it was not clear to the SMEs what was needed on this task.

S3215.1 Introduction to Instrumentation

Term “measurement” has been added throughout this learning outcome, measuring is the main component in this entire unit.

S3215.2 Instrumentation Installation Techniques

2.1

Bullet points have been merged to avoid unnecessary repetition.

2.2

Term “fabrication” has been changed to “design”, fabrication is part of the design of brackets.

Terms “steel and metal” have been removed, there are many more materials found and used for conduit and support brackets.



The following content:” Installing threaded pipe and fittings for a safe, leak-tight installation” has been changed to: “Identify thread types and fittings”. Installation is presented in 2.3.

2.3

Term “describe” has been changed to “apply”, this is better reflection of installation techniques.

2.4

The following content has been added: “Install tube fittings”, content was previously missing.

Term “tubing joints” has been changed to “tubing”, term commonly used in industry.

2.5

Terms “steel and metal” have been removed, there are many more materials found and used for conduit and support brackets.

Term “hand” has been removed as there are many tools used for threading that are not necessarily manual tools.

2.6

Term “control systems” has been removed

The following content has been added “use static and anti-static devices when working with electronic components”, it was previously missing.

Level 2 Reportable Subject Changes

- Learning outcome added
Learning outcome S3216.3 Capacitance has been added to covered content that has not been covered in any other area and that has to be individually presented to all Apprentices.
- Learning outcome renamed
Learning outcome S3220.2 Electrical Circuits and Ladder Diagrams has been renamed to Electrical Circuits and Ladder Programs since PLCs are the subject covered in this learning outcome. Programs are the main work covered and not diagrams.
- Learning outcomes merged



Learning outcome “AC Motors and Generators” and “DC Motors and Generators” have been merged into a single learning outcome, the content taught is the exact same one and it can be taught in the same lesson. The new combined learning outcome is S3216.5 Motors and Generators.

Level 2 Learning Outcome Content Changes

S3216.2 Magnetic devices

2.3

Term “impedance” has been added as it is part of the formula.

S3216.4 Capacitors, Inductors and Resistive Devices

General Learning Outcome

Terms “describe” and “build” have been added to better cover the needs of this learning outcome.

Term “source” has been replaced with “circuit” throughout entire learning outcome. Source is a device used in the system.

S3217.1 Instrumentation Test Equipment

General Learning Outcome

Term “configure” has been added due to digital instrumentation.

1.1

Term “current” has been changed to “process”.

Term “explain current loops” has been removed since it is not a piece of testing equipment.

Term “instrument calibration and definitions” have been changed to “calibration standards”. This new term encompasses all applicable terms.

S3217.2 Pressure Measurement

Terms “configure”, “troubleshoot”, “install” and “calibration” have been added throughout the entire learning outcome to better reflect industry terminology and applications.

2.1

Term “applications” has been removed. It is not necessarily an application and it could be a single measurement.



2.2

Term “accessory signal conditioning devices” has been replaced with “isolation methods” to better reflect industry terminology and applications.

2.3

Steps in this process have been added as they were previously missing “configure pressure transmitters” and “document calibration results”.

S3217.3 Level Measurement

Terms “configure” and “troubleshoot” have been added throughout the entire learning outcome to better reflect industry terminology and applications.

3.3

Below steps have been added as they were previously missing “configure level transmitters” and “document calibration results”.

S3217.4 Temperature Measurement

Terms “configure” and “troubleshoot” have been added throughout the entire learning outcome to better reflect industry terminology and applications.

4.1

Term “explain latent heat” has been added. It reflects change of state in energy.

4.2

Term “thermocouples” has been added, missing measuring devices.

Term “thermal” has been replaced with “systems”. There are many types of filled systems, not only thermal.

Term “thermocouples” has been replaced with “temperature elements” to better reflect current trade terminology and applications.

Term “environments” has been replaced with “applications” as it is a better description of where the instrument is applied and not the environment.



4.4

Terms “wire and connect” have been replaced by “install” as it encompasses both steps of the process.

S3217.5 Flow Measurement

Terms “configure” and “troubleshoot” have been added throughout the entire learning outcome to better reflect industry terminology and applications.

5.2

Term “3 valve” has been changed to “isolation” to better reflect current trade terminology and applications.

5.3

Terms “wire and connect” have been replaced by “install” as it encompasses both steps of the process.

S3217.6 Secondary Process Measurement

Terms “configure” and “troubleshoot” have been added throughout the entire learning outcome to better reflect industry terminology and applications.

6.3

Terms “wire and connect” have been replaced by “install” as it encompasses both steps of the process.

S3218.1 Final Control Elements

General Learning Outcome

Term “solenoid” has been removed as there are more valve types than just solenoid valves.

1.1

Term “I/P” has been added to better reflect current trade terminology and applications.

S3218.2 Control System Fundamentals

Term “calibrate” has been replaced with “tune” throughout the entire learning outcome to better reflect industry terminology and applications.



2.2

Term “control” has been changed to “controllers”.

S3218.3 Valve Positioners

General Learning Outcome

Term “petitioners” has been replaced with “positioners” to better reflect industry terminology and applications.

S3219.1 Introduction to Discrete Control

Term “demonstrate” has been replaced with “identify” as it is difficult to demonstrate with theory only.

Term “pneumatic” has been removed throughout the entire learning outcome as there are more types of timers.

1.1

Term “define” has been replaced with “explain” as it is difficult to demonstrate with theory only.

Term “pneumatic” has been removed as there are more types of timers.

1.3

Term “pilot” has been removed as there are more types of control devices.

1.4

Term “specifications” has been added to better reflect industry terminology and applications.

S3219.2 Control System Electrical Schematics

Term “motors (single/three phases) and electrical solenoid valves” has been removed. This terminology is too specific to the content that is being taught in-school.

S3219.3 Discrete Control Wiring

Term “pneumatic” has been removed throughout the entire learning outcome as there are more types of timers.

General Learning Outcome

Terms “pilot”, “starters” and “motors” have been removed as they are all devices.



3.2

Term “according to Canadian Electrical Safety Code Part 2, manual and magnetic full voltage (reversing and non-reversing) motor starters. This content is not taught in-school.

S3220.1 Introduction to DCS, PLC and SCADA Systems

1.7

Term “or” has been added as not all TDA’s have both systems.

S3220.2 Electrical Circuits and Ladder Programs

Term “diagrams” has been replaced with “programs” throughout the entire learning outcome to better reflect industry terminology and applications.

Terms “build”, “electrical”, “electrical circuits” and “Distributed Control Systems (DCS)” have been removed throughout the entire learning outcome to better reflect industry terminology and applications.

S3220.3 Configuration and Programming

The following content has been added “configure function blocks” as it was missing and it is an important step within configuration and programming.

S3220.4 Control System Troubleshooting

4.1

The term “control” has been replaced with hardware and/or software to better reflect industry terminology and applications.

S3220.5 System Configuration, Interfacing and Communications
General Learning Outcome

Term “commission” has been added. This is an important step in verification of proper function in the system, troubleshooting comes into place if there is no commissioning.

The term “set-up procedures” has been removed as commission and troubleshoot are part of set-up.

Level 3 Reportable Subject Changes

- Learning outcomes added



Learning outcome S3223.5 Safety Systems has been added to covered content that has not been viewed in any other area.

- Learning outcome renamed
Learning outcome S3223.3 Industrial Networks and Data Transfer Methods has been renamed.
- Learning outcome re-located
Learning outcome S3223.1 Control Tuning has been re-located to ensure a logical order.

Level 3 Learning Outcome Content Changes

S3221.2 Power Supply, Regulation and Amplifiers
General Learning Outcome

The terms “voltage regulation” and “performance” have been removed as they are steps implied within test and troubleshoot.

2.5

The term “emitter” has been added.

S3221.4 Manufacturer’s Connection Schematics and Diagrams
General Learning Outcome

Term “process loops” has been added. It was already in the content, but not in the GLO.

S3221.5 Final Control Elements

Term “control valves” has been added throughout the entire learning outcome missing component in list of final control elements.

S3222.1 PLC and DCS Control Systems
General Learning Outcome

Term “or” has been added as not all TDA’s have both systems.

1.3

Term “Man-Machine Interface (MMI)” has been removed as it is not politically correct.

1.4

Term “cards for field function and connections” has been removed, it is not needed since I/O covers it.



Term “other’ has been removed, it is not needed.

S3222.2 PLC and DCS Control Problem Solving Techniques
General Learning Outcome

Term “using problem solving techniques” has been removed, it is implied within troubleshooting.

2.2.1

The content of this bullet point has been removed from this learning outcome “plan and organize a DCS/PLC project using standard function block and ladder nomenclature”. It has been covered in the previous learning outcome.

2.3

Terms “realistic”, “timers”, “counters”, “latches” and “using logic instructions such as: timing and counting instructions” have been removed, they are not needed.

S3223.1 Control Tuning

General Learning Outcome

Term “approved” has been removed, it is implied it has already being approved if it is being used.

S3223.2 Control Systems

Term “test” has been replaced with “commission” and “tune” throughout the entire learning outcome to better reflect industry terminology and applications.

S3223.3 Industrial Networks and Data Transfer

General Learning Outcome

Terms “commission” and “troubleshoot” have been added to better reflect industry terminology and applications.

Term “computer controls” has been replaced with “ industrial networks” to better reflect industry terminology and applications.
Term “common industrial networks” has been removed.

3.1

Term “computer and microprocessor – based controller terminology” has been replaced with “network topologies and protocols”, they are pieces of hardware and not a communication piece.



3.3 and 3.4

The content in these two bullet points has been added, missing steps in previous document.

S3223.4 Troubleshooting Control Systems

Term “controller” has been replaced with “control” throughout the entire learning outcome, the troubleshooting is for an entire system and not a piece of equipment.

General Learning Outcome

Term “to rectify common system problems” has been removed.

4.1

Term “typical” has been removed.

S3224.1 Introduction to Analyzers and Analytics Process Measurement

General Learning Outcome

Term “related to analytical process measurement” has been removed, it is redundant.

S3224.2 Analyzers Sampling System

General Learning Outcome

Term “according to the manufacturer’s design” has been removed, there are other factors applicable to sampling besides manufacturer.

2.2

Term “proper” has been replaced with “appropriate”.

S3225.1 Fundamentals of Fluid Power System

General Learning Outcome

Term “demonstrate the ability” has been removed as no demonstration can be done during theory.

1.1

The following content has been removed since Apprentices have already learnt it in level 1: “Define basic principles for force, work and power: weight and specific gravity; pressure, force and area; static pressure; gauge pressures in English and Metric units; Pascal’s Law and Bernoulli’s principle; conversion of energy and fluid power; pressure losses”.



1.2

Term “draw” has been changed to “identify” to better reflect industry terminology and applications.

S3225.2 Hydraulic Systems

General Learning Outcome

Term “according to the manufacturer’s design” has been removed, there are other factors applicable to hydraulic systems besides manufacturer.

2.1

Term “construction features and types” has been removed.

S3225.3 Pneumatic Systems

General Learning Outcome

Term “according to the manufacturer’s recommendations and specifications” has been removed, there are other factors applicable to hydraulic systems besides manufacturer.

3.1

Term “dew point measurement” has been added.

Terms “pipes and fittings”, “gauges”, “intensifiers”, “controllers and recorders”, “sensors” and “pneumatic tools” have been removed.

3.2

Terms “air flow control circuits” and “pressure and flow gauges” have been removed.

S0384.4

Entire learning outcome has been removed as all content has already been covered in previous learning outcomes.



Hour Changes

Level 1 hours allocation

There has been a re-allocation of 2 hours from Theory to Practical components as showing below:

2008

Number	Reportable Subjects	Hours		
		Total	Theory	Practical
S0370	Applied Trade Practices and Procedures	9	9	0
S0371	Electrical Theory and Applied Trade Calculations I	63	37	26
S0372	Electronic Systems I	63	30	33
S0373	Computers and Documentation	30	1	29
S0374	Instrumentation I	75	33	42
		240	110	130

2016

Number	Reportable Subjects	Hours		
		Total	Theory	Practical
S3211	Applied Trade Practices and Procedures	9	9	0
S3212	Electrical Theory and Applied Trade Calculations	63	35	28
S3213	Electronic Systems I	63	30	33
S3214	Computers and Documentation	30	1	29
S3215	Instrumentation I	75	33	42
		240	108	132



Level 2 hours allocation

There has been a re-allocation of 10 hours from Theory to Practical and hours were re-allocated in between learning outcomes to encompass the content taught in-school components as showing below:

2008

Number	Reportable Subjects	Hours		
		Total	Theory	Practical
S0375	Electrical Theory and Applied Trade Calculations II	48	36	12
S0376	Instrumentation II	63	30	33
S0377	Instrumentation Controls I	54	29	25
S0378	Discrete Control	36	24	12
S0379	Computer Control Systems	39	14	25
		240	133	107

2016

Number	Reportable Subjects	Hours		
		Total	Theory	Practical
S3216	Electrical Theory and Applied Trade Calculations II	33	26	7
S3217	Instrumentation II	69	35	34
S3218	Instrumentation Controls I	63	31	32
S3219	Discrete Control	27	16	11
S3220	Computer Control Systems	48	15	33
		240	123	117



Level 3 hours allocation

There has been a re-allocation of 3 hours from Theory to Practical and hours were re-allocated in between learning outcomes to encompass the content taught in-school components as showing below:

2008

Number	Reportable Subjects	Hours		
		Total	Theory	Practical
S0380	Applied Circuits	42	24	18
S0381	Advanced PLC and DCS	57	14	43
S0382	Instrumentation Controls II	75	47	28
S0383	Analytical Instrumentation	36	30	6
S0384	Fluid Power Systems	30	22	8
		240	137	103

2016

Number	Reportable Subjects	Hours		
		Total	Theory	Practical
S3221	Applied Circuits	42	23	19
S3222	Advanced PLC and DCS	57	14	43
S3223	Instrumentation Controls II	90	52	38
S3224	Analytical Instrumentation	36	32	4
S3225	Fluid Power Systems	15	13	2
		240	134	106

General Notes	<p>Rationale:</p> <ul style="list-style-type: none"> • Curriculums for Level 1, Level 2 and Level 3 were last updated in 2008 and are outdated. • Keep current with the growing needs of the industry and Apprentices. • To expand on trade knowledge to increase Apprentice competency and completion rates. • Use of appropriate trade terminology to coincide with the National Occupational Analysis (NOA), which clarifies terms used on exams and enhances completion rates. • To align content, sequencing and hours according to the recently updated Training Standard. • Industry feedback indicates that a more educated workforce enhances production and safety as well as less down time, damage to tools, materials and equipment
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