



Saskatchewan
Apprenticeship and
Trade Certification
Commission

Apprenticeship

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**ELECTRONICS ASSEMBLER OCCUPATIONAL ANALYSIS
FOR SASKATCHEWAN**

March 16, 2011

**SASKATCHEWAN APPRENTICESHIP AND TRADE
CERTIFICATION COMMISSION**



- BLOCK** – is the largest division within the analysis and reflects a distinct operation relevant to the occupation.
- A. **TASK** – is the distinct activity that, combined with others, makes up the logical and necessary steps the worker is required to perform to complete a specific assignment within a “BLOCK”.
 - B. **SUB-TASK** – is the smallest division into which it is practical to subdivide any work activity and, combined with others, fully describes all duties constituting a “TASK”.
 - C. **SUPPORTING KNOWLEDGE AND ABILITIES** – is the element that an individual must acquire to adequately perform the task is identified under this heading.
 - D. **SAFETY** – safe working procedures and conditions, accident prevention and the preservation of health are of primary importance to industry in Saskatchewan and Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to an accident or injury.

It is generally recognized that a safety-conscious attitude and work practices contribute to a healthy, safe and accident-free working environment.

It is imperative to apply and be familiar with the Occupational Health and Safety Act and Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

As safety education is an integral part of training in all jurisdictions, personal safety practices are not recorded in this document. However, the technical safety aspect relating to each task and sub-task are included throughout this analysis.
(As adapted from Human Resources Development Canada; Occupational Analyses Series (Red Seal Interprovincial Standards.)

BLOCK A

PREPARES FOR PRODUCTION

Task 1 Follows company policies and production flow requirements

Sub-task 1.01 Follows safety procedures

Supporting Knowledge and Abilities

- 1.01.01 Knowledge of WHMIS
- 1.01.02 Knowledge of CSA
- 1.01.03 Knowledge of hazards in lifting/carrying material
- 1.01.04 Knowledge of safe practices

Sub-task 1.02 Follows delivery schedules

Supporting Knowledge and Abilities

- 1.02.01 Knowledge of order tracking systems
- 1.02.02 Ability to estimate time requirements
- 1.02.03 Knowledge of customer requirements

Sub-task 1.03 Follows Quality Assurance procedures

Supporting Knowledge and Abilities

- 1.03.01 Knowledge of quality management systems
- 1.03.02 Knowledge of ISO
- 1.03.03 Knowledge of the purpose of traceability
- 1.03.04 Ability to use sampling plans such as ANSI, mil spec.
- 1.03.05 Ability to recommend manufacturability adjustments

Sub-task 1.04 Understands employer organization

Supporting Knowledge and Abilities

- 1.04.01 Knowledge of company organization charts
- 1.04.02 Knowledge of Human Resources policies
- 1.04.03 Knowledge of employer practices and procedures

Sub-task 1.05 Follows material management and handling policies

Supporting Knowledge and Abilities

- 1.05.01 Knowledge of just-in-time
- 1.05.02 Knowledge of part numbering systems
- 1.05.03 Knowledge of bill of material process
- 1.05.04 Knowledge of batch and one piece flow processing systems
- 1.05.05 Knowledge of processes such as Kan Ban, Floor stock etc.
- 1.05.06 Ability to package assemblies
- 1.05.07 Ability to use material handling equipment
- 1.05.08 Knowledge of packaging materials and their applications such as bubble pack, static shielding/dissipative
- 1.05.09 Knowledge of correct packaging techniques

Sub-task 1.06 Understands contract requirements

Supporting Knowledge and Abilities

- 1.06.01 Knowledge of unique specifications such as military, aerospace etc.
- 1.06.02 Knowledge of lead free export requirements

Task 2 Identifies materials and components

Sub-task 2.01 Ability to identify fasteners

Supporting Knowledge and Abilities

- 2.01.01 Knowledge of fastener types
- 2.01.02 Knowledge of fastener uses

Sub-task 2.02 Ability to identify electronic devices and materials

Supporting Knowledge and Abilities

- 2.02.01 Knowledge of types of electronic devices
- 2.02.02 Knowledge of electronic materials
- 2.02.03 Knowledge of solder types
- 2.02.04 Ability to interpret colour coding
- 2.02.05 Ability to interpret component ID markings
- 2.02.06 Ability to interpret component orientation/polarity indicators

		2.02.07	Knowledge of solder/flux compatibility
Sub-task	2.03	Ability to identify hand tools	
		<u>Supporting Knowledge and Abilities</u>	
		2.03.01	Knowledge of hand tools types
		2.03.02	Knowledge of soldering irons and tips
Sub-task	2.04	Ability to identify power tools	
		<u>Supporting Knowledge and Abilities</u>	
		2.04.01	Knowledge of power tool types
		2.04.02	Knowledge of power tool uses
Task 3	Interprets documentation		
Sub-task	3.01	Reads schematics	
		<u>Supporting Knowledge and Abilities</u>	
		3.01.01	Knowledge of schematic symbols and reference designators
		3.01.02	Ability to interpret from a schematic
		3.01.03	Knowledge of electronics
		3.01.04	Knowledge of basic and configuration math
Sub-task	3.02	Reads wiring lists	
		<u>Supporting Knowledge and Abilities</u>	
		3.02.01	Ability to determine wire length
		3.02.02	Ability to determine wire gauge
		3.02.03	Ability to determine termination instructions
		3.02.04	Ability to interpret wiring from the wire list
Sub-task	3.03	Reads engineering assembly drawings	
		<u>Supporting Knowledge and Abilities</u>	
		3.03.01	Ability to interpret mechanical drawings
		3.03.02	Ability to read circuit card layouts

Sub-task 3.04 Reads work instructions

Supporting Knowledge and Abilities

- 3.04.01 Ability to decipher sequence of tasks
- 3.04.02 Ability to read with comprehension
- 3.04.03 Knowledge of best practises

Sub-task 3.05 Interprets workmanship standards

Supporting Knowledge and Abilities

- 3.05.01 Knowledge of international standards
- 3.05.02 Knowledge of corporate and/or client standards
- 3.05.03 Ability to use measurement tools
- 3.05.04 Ability to use magnification tools
- 3.05.05 Ability to determine pass/fail
- 3.05.06 Ability to determine which workmanship standard applies (Lead/Lead free, Client/Internal)

Sub-task 3.06 Operates computers

Supporting Knowledge and Abilities

- 3.06.01 Ability to use the internet
- 3.06.02 Ability to use e-mail
- 3.06.03 Ability to use office suite
- 3.06.04 Ability to use automated test software programs

Task 4 Follows ESD (electrostatic discharge) procedures

Sub-task 4.01 Verifies ESD equipment functionality

Supporting Knowledge and Abilities

- 4.01.01 Knowledge of ESD equipment
- 4.01.02 Ability to perform ESD equipment test

Sub-task 4.02 Uses ESD materials and equipment

Supporting Knowledge and Abilities

- 4.02.01 Knowledge of ESD materials
- 4.02.02 Knowledge of ESD policies
- 4.02.03 Knowledge of ESD and its potential damage
- 4.02.04 Ability to select appropriate precautions

Sub-task 4.03 Follows specialized handling procedures

Supporting Knowledge and Abilities

4.03.01 Knowledge of clean room procedures

4.03.02 Knowledge of moisture sensitive components

4.03.03 Ability to use specialized handling processes

BLOCK B

PRODUCES CIRCUIT CARDS

Task 5 Builds cards as required

Sub-task 5.01 Prepares components

Supporting Knowledge and Abilities

- 5.01.01 Ability to tin leads (using solder pot/iron)
- 5.01.02 Ability to pre-form leads using manual tools
- 5.01.03 Knowledge of component handling requirements/precautions
- 5.01.04 Ability to select components
- 5.01.05 Ability to determine component preparation requirements
- 5.01.06 Knowledge of pre-forming leads using machine pre-forming equipment

Sub-task 5.02 Populates cards

Supporting Knowledge and Abilities

- 5.02.01 Ability to insert components by hand
- 5.02.02 Knowledge of the operation of semi-automated and automated insertion equipment
- 5.02.03 Knowledge of the operation and adjustments required by pick and place machines

Sub-task 5.03 Performs second assembly

Supporting Knowledge and Abilities

- 5.03.01 Ability to install and secure hardware
- 5.03.02 Ability to install cable/wires including hand soldering and securing
- 5.03.03 Ability to insert socketed components
- 5.03.04 Ability to apply labels
- 5.03.05 Ability to apply compounds such as heat sink compound

Task 6 Hand solders circuit cards using tin/lead technology

Sub-task 6.01 Produces CCA's (circuit card assemblies) with surface mount technology

Supporting Knowledge and Abilities

6.01.01 Ability to select and operate hand soldering equipment

6.01.02 Ability to inspect for defects

Sub-task 6.02 Reworks CCA's with surface mount technology

Supporting Knowledge and Abilities

6.02.01 Ability to remove surface mount components (excluding BGA's)

6.02.02 Ability to remove solder

6.02.03 Ability to perform solder joint touch-up

Sub-task 6.03 Repairs CCA's with surface mount technology

Supporting Knowledge and Abilities

6.03.01 Ability to identify major faults and damage

6.03.02 Ability to replace components

6.03.03 Ability to repair tracks and lands

6.03.04 Knowledge of repair procedures

Sub-task 6.04 Produces CCA's with through-hole technology

Supporting Knowledge and Abilities

6.04.01 Ability to identify component and solder side of CCA

6.04.02 Ability to select and operate hand soldering equipment

6.04.03 Ability to inspect for defects

Sub-task 6.05 Reworks CCA's with through-hole technology

Supporting Knowledge and Abilities

6.05.01 Ability to remove through-hole components

6.05.02 Ability to perform solder joint touch-up

6.05.03 Ability to remove solder

Sub-task 6.06 Repairs CCA's with through-hole technology

Supporting Knowledge and Abilities

- 6.06.01 Ability to identify major faults and damage
- 6.06.02 Ability to replace components
- 6.06.03 Ability to repair tracks and barrels
- 6.06.04 Knowledge of repair procedures

Task 7 Hand solders circuit cards using lead free technology

Sub-task 7.01 Produces CCA's (circuit card assemblies) with surface mount technology

Supporting Knowledge and Abilities

- 7.01.01 Ability to select and operate hand soldering equipment
- 7.01.02 Ability to inspect for defects

Sub-task 7.02 Reworks CCA's with surface mount technology

Supporting Knowledge and Abilities

- 7.02.01 Ability to remove surface mount components (excluding BGA's)
- 7.02.02 Ability to remove solder
- 7.02.03 Ability to perform solder joint touch-up

Sub-task 7.03 Repairs CCA's with surface mount technology

Supporting Knowledge and Abilities

- 7.03.01 Ability to identify major faults and damage
- 7.03.02 Ability to replace components
- 7.03.03 Ability to repair tracks and lands
- 7.03.04 Knowledge of repair procedures

- Sub-task 7.04 Produces CCA's with through-hole technology
- Supporting Knowledge and Abilities
- 7.04.01 Ability to identify component and solder side of CCA
 - 7.04.02 Ability to select and operate hand soldering equipment
 - 7.04.03 Ability to inspect for defects

- Sub-task 7.05 Reworks CCA's with through-hole technology
- Supporting Knowledge and Abilities
- 7.05.01 Ability to remove through-hole components
 - 7.05.02 Ability to perform solder joint touch-up
 - 7.05.03 Ability to remove solder

- Sub-task 7.06 Repairs CCA's with through-hole technology
- Supporting Knowledge and Abilities
- 7.06.01 Ability to identify major faults and damage
 - 7.06.02 Ability to replace components
 - 7.06.03 Ability to repair tracks and barrels
 - 7.06.04 Knowledge of repair procedures

Task 8 Machine solders circuit cards

- Sub-task 8.01 Prepares printed wiring board (PWB)
- Supporting Knowledge and Abilities
- 8.01.01 Ability to select appropriate solder paste (tin/lead, lead free)
 - 8.01.02 Ability to apply solder paste (hand/machine)
 - 8.01.03 Knowledge of stencil handling procedures
 - 8.01.04 Ability to inspect solder paste application
 - 8.01.05 Ability to heat treat PWB's
 - 8.01.06 Ability to mask PWB's

Sub-task 8.02 Wave solders using various wave soldering equipment

Supporting Knowledge and Abilities

- 8.02.01 Ability to perform pre-wave inspection
- 8.02.02 Knowledge of fluxes, solders, oils, temperatures, and jigs
- 8.02.03 Knowledge to prepare/set-up the wave soldering equipment (machine/mini wave/selective wave soldering)
- 8.02.04 Knowledge of techniques used to run wave soldering equipment
- 8.02.05 Ability to perform visual inspection
- 8.02.06 Knowledge of equipment maintenance (does not include major repairs/maintenance/overhauls)

Sub-task 8.03 Reflow solders circuit cards

Supporting Knowledge and Abilities

- 8.03.01 Ability to perform pre-reflow inspection
- 8.03.02 Knowledge of temperature profiles for reflow ovens
- 8.03.03 Knowledge of oven operation and adjustment
- 8.03.04 Ability to perform visual inspection
- 8.03.05 Knowledge of manufacturability requirements
- 8.03.06 Knowledge of the use of x-ray machines and/or Ball Grid Array (BGA) inspection tools to inspect BGA's

Sub-task 8.04 Selective solders circuit cards (non-wave)

Supporting Knowledge and Abilities

- 8.04.01 Knowledge of non-wave selective solder technology and operation
- 8.04.02 Knowledge of fluxes, solders, temperatures, and jigs
- 8.04.03 Knowledge of machine set up
- 8.04.04 Ability to perform visual inspection

Task 9 Cleans cards after production

Sub-task 9.01 Hand cleans CCA's

Supporting Knowledge and Abilities

9.01.01 Ability to identify contaminant type

9.01.02 Ability to select and apply cleaning method/agent

Sub-task 9.02 Machine cleans cards

Supporting Knowledge and Abilities

9.02.01 Knowledge of automated cleaning technology

9.02.02 Knowledge of machine operation including board placement requirements

Task 10 Applies environmental coatings to cards

Sub-task 10.01 Sprays cards

Supporting Knowledge and Abilities

10.01.01 Knowledge of conformal coating spray equipment for CCA's (cans/bulk application equipment)

10.01.02 Ability to identify defects

10.01.03 Knowledge of touch-up coating techniques

Sub-task 10.02 Dips cards

Supporting Knowledge and Abilities

10.02.01 Knowledge of coating thickness requirements

10.02.02 Knowledge of dipping equipment operation

10.02.03 Ability to identify defects

10.02.04 Knowledge of touch up coating techniques

Sub-task 10.03 Reworks environmental coatings

Supporting Knowledge and Abilities

10.03.01 Knowledge of coating removal techniques

10.03.02 Knowledge of conformal coating touch up

Sub-task 10.04 Dispense potting compound

Supporting Knowledge and Abilities

- 10.04.01 Knowledge of potting compound technology
- 10.04.02 Knowledge of unit preparation for potting compound
- 10.04.03 Knowledge of potting compound machine operation

BLOCK C
PRODUCES CABLES, WIRES AND HARNESSSES

Task 11 **Prepares cables**

Sub-task 11.01 Cuts cables

Supporting Knowledge and Abilities

- 11.01.01 Ability to identify cable/wire types
- 11.01.02 Ability to determine cable/wire lengths
- 11.01.03 Knowledge of metric/imperial systems
- 11.01.04 Ability to select and operate manual cutters (both single and multiple conductors)
- 11.01.05 Knowledge of machine cutters (both single and multiple conductors)

Sub-task 11.02 Strips cables

Supporting Knowledge and Abilities

- 11.02.01 Ability to determine strip length
- 11.02.02 Ability to select and operate manual stripping equipment for both single and multiple conductor cables/wires
- 11.02.03 Ability to inspect strip and adjust equipment if required
- 11.02.04 Knowledge of machine stripping equipment for both single and multiple conductor cables/wires

Sub-task 11.03 Tins cables

Supporting Knowledge and Abilities

- 11.03.01 Ability to inspect a tined wire
- 11.03.02 Ability to tin cables/wires

Sub-task 11.04 Labels cables

Supporting Knowledge and Abilities

- 11.04.01 Ability to retrieve cable/wire identification information from paper and electronic sources
- 11.04.02 Ability to apply information to labels
- 11.04.03 Ability to apply labels

Task 12 Terminates cables

Sub-task 12.01 Solders connectors

Supporting Knowledge and Abilities

- 12.01.01 Ability to identify and select connectors
- 12.01.02 Ability to select and perform soldering technique
- 12.01.03 Ability to inspect solder connection

Sub-task 12.02 Crimps connectors

Supporting Knowledge and Abilities

- 12.02.01 Ability to identify and select connectors
- 12.02.02 Ability to select and operate crimping tool
- 12.02.03 Ability to inspect/test crimp

Sub-task 12.03 Attaches heat shrink (reflow) connectors

Supporting Knowledge and Abilities

- 12.03.01 Ability to identify and select connector
- 12.03.02 Ability to install reflow connectors
- 12.03.03 Ability to inspect/test connection

Sub-task 12.04 Attaches mechanical terminations

Supporting Knowledge and Abilities

- 12.04.01 Ability to identify and select connector
- 12.04.02 Ability to perform insertions and extractions
- 12.04.03 Ability to select and operate wire tools
- 12.04.04 Ability to assemble backshells
- 12.04.05 Ability to shrink insulation tubing

Task 13 **Assembles harnesses**

Sub-task 13.01 Route wires/cables

Supporting Knowledge and Abilities

- 13.01.01 Ability to select prepared cables
- 13.01.02 Knowledge of bend radius, service loops, breakout points and cable protection
- 13.01.03 Ability to plan assembly for neat appearance and minimal crossovers

Sub-task 13.02 Bundle wires/cables

Supporting Knowledge and Abilities

- 13.02.01 Ability to select and apply lacing techniques
- 13.02.02 Ability to select and apply fasteners such as tie wraps and velcro
- 13.02.03 Ability to inspect installation.

BLOCK D

ASSEMBLES CHASSIS AND RACKS

Task 14 Prepares chassis, subassemblies and racks

Sub-task 14.01 Assembles chassis and racks

Supporting Knowledge and Abilities

14.01.01 Ability to select and use hand and power tools

14.01.02 Ability to select and install fasteners

Sub-task 14.02 Modifies/reworks/repairs metalwork

Supporting Knowledge and Abilities

14.02.01 Ability to modify rework or repair such as grinding, cutting, drilling, deburring, filing, bending and punching

14.02.02 Knowledge of surface touch up techniques (paint/alodyning)

14.02.03 Knowledge of special fasteners such as clinch nuts, and helicoils

Task 15 Installs components

Sub-task 15.01 Installs components by mechanical means

Supporting Knowledge and Abilities

15.01.01 Knowledge of hardware stacking

15.01.02 Ability to select and install fasteners

15.01.03 Knowledge of torque tools

15.01.04 Ability to adjust torque settings

Sub-task 15.02 Installs components by adhesives

Supporting Knowledge and Abilities

15.02.01 Knowledge of glues and adhesives

15.02.02 Ability to apply glues and adhesives

Sub-task 15.03 Applies labels and markings

Supporting Knowledge and Abilities

- 15.03.01 Knowledge of marking techniques such as ink stamping, metal stamping, and stencils
- 15.03.02 Ability to select and apply labels and markings
- 15.03.03 Knowledge of contractual requirements

Sub-task 15.04 Installs harnesses

- 15.04.01 Ability to select prepared harnesses
- 15.04.02 Ability to attach harnesses to subassemblies
- 15.04.03 Ability to route harnesses
- 15.04.04 Ability to secure harnesses to chassis/racks

BLOCK E
TESTS PRODUCTS

Task 16 **Uses multimeter**

Sub-task 16.01 Test for continuity

Supporting Knowledge and Abilities

- 16.01.01 Knowledge of impedance test procedures
- 16.01.02 Ability to use a multimeter to test continuity
- 16.01.03 Ability to use “beep-out boxes”

Sub-task 16.02 Test for voltages

Supporting Knowledge and Abilities

- 16.02.01 Knowledge of AC/DC theory
- 16.02.02 Ability to use a multimeter to test voltage

Sub-task 16.03 Tests for current

Supporting Knowledge and Abilities

- 16.03.01 Knowledge of amperage test procedures
- 16.03.02 Ability to use a multimeter to test current

Sub-task 16.04 Tests for diode polarity

Supporting Knowledge and Abilities

- 16.04.01 Knowledge of diode current flow characteristics
- 16.04.02 Knowledge of basic circuits
- 16.04.03 Ability to use a multimeter to test diode polarity

Task 17 **Uses basic electronic test equipment and automated test/programming software**

Sub-task 17.01 Connects DUT (device under test) to test equipment

Supporting Knowledge and Abilities

- 17.01.01 Knowledge of DUT input/output connections
- 17.01.02 Awareness of spectrum and network analyzers, oscilloscopes and power meters
- 17.01.03 Awareness of automated test software uses

Sub-task 17.02 Operates test equipment and interprets test results

Supporting Knowledge and Abilities

- 17.02.01 Ability to follow test procedures
- 17.02.02 Knowledge of test expectations
- 17.02.03 Ability to determine pass/fail
- 17.02.04 Ability to record test results
- 17.02.05 Ability to document failure mechanism
- 17.02.06 Awareness of tuning circuits

Sub-task 17.03 Follows corrective procedures when required

Supporting Knowledge and Abilities

- 17.03.01 Knowledge of non-conforming product handling procedures
- 17.03.02 Ability to fill out repair tags or non-conformance reports

Sub-task 17.04 Programs devices

Supporting Knowledge and Abilities

- 17.04.01 Knowledge of component level micro programming techniques
- 17.04.02 Knowledge of CCA level micro programming techniques